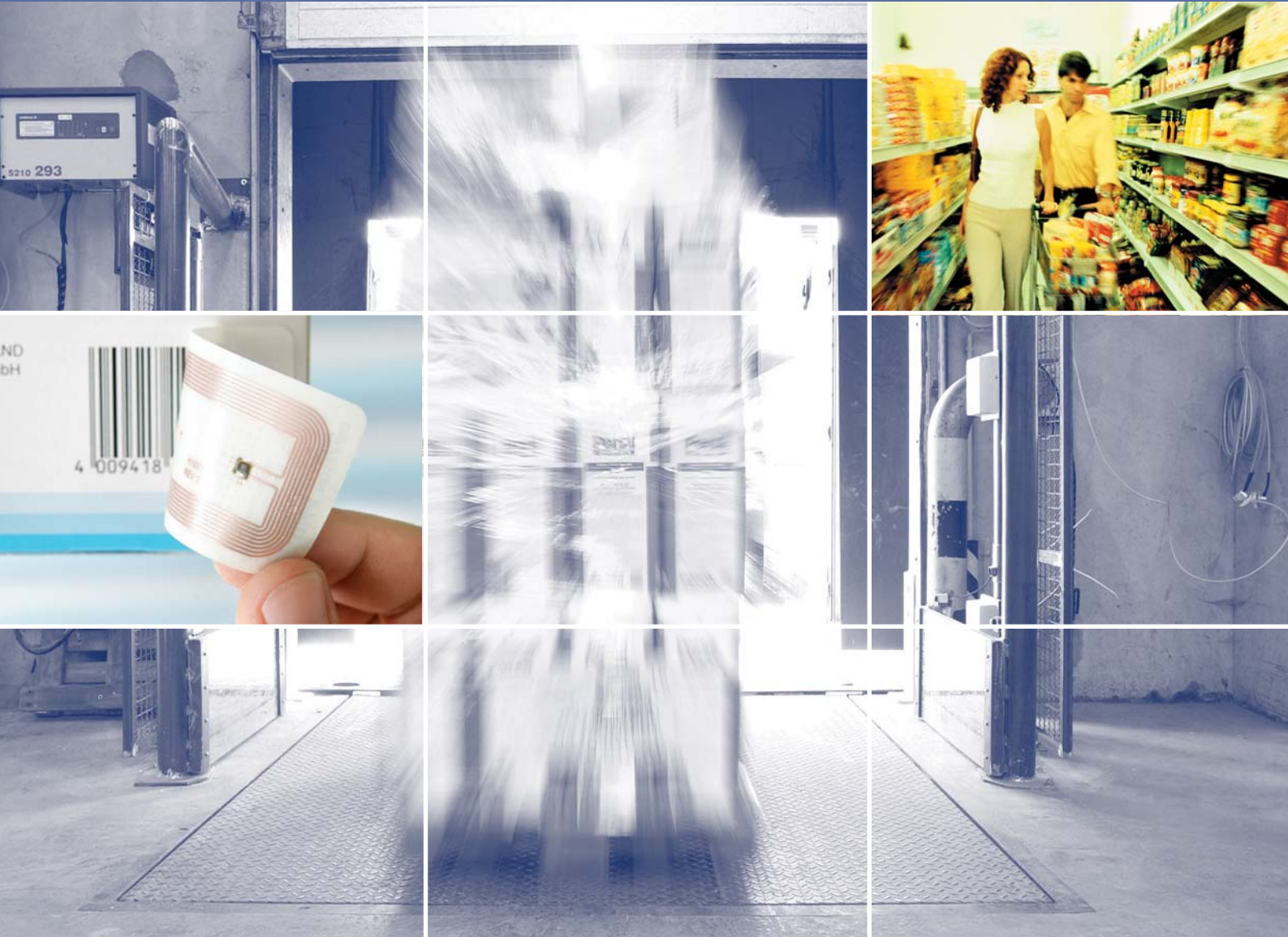


EPC: A Shared Vision for Transforming Business Processes



IBM[®]

Published in association with IBM


gci
GLOBAL
COMMERCE
INITIATIVE

*Cover images of receiving dock and RFID tag are the property of METRO Group.
© Copyright 2005. Used by permission.*



Contents

1 Introduction	2-4
1.1 Foreword	2
1.2 Acknowledgments	4
2 Executive Summary	5-8
2.1 A Shared EPC Vision	5
2.2 Top-Level Conclusions	6
2.3 Required Industry Actions	8
3 The EPC Vision	9-14
3.1 EPC: The Next Wave	9
3.2 Learning from the Past: The Barcode Experience	12
4 Exploiting EPC's Full Potential: Scenarios for Transformation	15-42
4.1 Store Operations	18
4.2 Distribution Operations	24
4.3 Direct Store Delivery	30
4.4 Promotion/Event Execution	35
4.5 Total Inventory Management	37
4.6 Shrink Management	41
5 Industry Action Plan	43-47
5.1 Actions for Individual Companies	43
5.2 Actions for Improved Trading Partner Collaboration	45
5.3 Actions for the Industry as a Whole to Address Critical Technology Issues	46
Appendix A: Building the Business Case for EPC	48-51
A.1 EPC Benefit Drivers	48
A.2 EPC Cost Drivers	49
A.3 Improved On-shelf Availability	49
A.4 Increased Labor Productivity	50
Appendix B: Key References	52



1. Introduction

1.1 Foreword

In November 2003, the Global Commerce Initiative (GCI) published the "The EPC Roadmap", a report that outlined the combined technology and process initiatives that have the potential to revolutionize the consumer products/retail industry. In this report, the GCI Executive Board strongly recommended the global standards-based implementation of radio frequency identification (RFID) technology, supported by the use of standards-based tags, readers, tag content and information flows in the retail supply chain. In 2004, the first set of global standards were developed and established via EPCglobal, a worldwide, user-driven standards organization for the Electronic Product Code (EPC).

Over the past two years, significant progress has been made on the commercial use of EPC in our industry. Examples include the standardization of new "Generation 2" technology for transponders and readers and the implementation of EPC technology by leading retailers and manufacturers in various parts of the world. These early adoptions have delivered significant benefits to both the consumer shopping experience and industry supply chain

efficiency and have highlighted that great opportunities remain for further innovation and improvement in both areas. They have also shown, however, that challenges and barriers to broad implementation of EPC still exist.

This report represents a joint assessment by GCI members, including representatives from both the manufacturer and retailer communities. The objective is to provide senior industry leaders with pragmatic insights on how RFID/EPC technology can help drive major changes in the industry supply chain that lead to benefits for all participants.

Leading retailers and manufacturers share the ultimate vision of an EPC-enabled supply chain that brings significant service and efficiency benefits to shoppers, end consumers and businesses. The EPC-enabled supply chain will enable trading partners to meet shopper and consumer needs in ways far superior to what is possible today.

This report focuses on case- and pallet-level tagging, extending from the manufacturer's distribution center to the retailer's sales

floor. It builds upon accumulated industry experience to describe detailed, practical steps for transforming key supply chain processes and utilizing EPC technology. Specifically, the report seeks to provide:

- *An updated vision for EPC adoption in the consumer products/retail industry*
- *Scenarios explaining the transformational potential of EPC technology that can be exploited through changes in business processes, within and across trading partners*
- *Steps that individual companies, trading partners and the industry as a whole need to take to move toward the vision of EPC-enabled supply chains.*

EPC adoption is already happening today as leading companies actively pilot and deploy EPC to address many of the areas discussed later in this report. It is, however, very much a work-in-progress. While we have made significant advances in understanding how EPC can be used to drive anticipated benefits, we still have much to learn. We encourage you and your company to make use of the insights presented in this report to

better understand the value and challenges of collaborative implementation of EPC-enabled supply chain processes across the industry at large. The key guidelines to accelerate the process of EPC adoption are:

- *Increase awareness of the EPC vision; experiment and investigate opportunities for using EPC in your own company*
- *Deepen your knowledge of potential EPC benefits and implementation requirements and participate in industry groups, especially EPCglobal, at local, regional or global levels to share learnings and engage in the standards-setting process*
- *Improve collaboration among trading partners (manufacturers and retailers)*
- *Understand and proactively address the consumer and public policy perspectives on EPC.*

Let's make it happen together!

Antony Burgmans
Unilever

Lee Scott
Wal*Mart Stores

Co-Chairmen of the GCI Executive Board

1.2 Acknowledgements

The GCI and IBM Business Consulting Services, which conducted the research and writing of this report, wish to thank the following people for providing support, guidance and invaluable input in the course of this effort:

Joe Andraski, Voluntary Interindustry Commerce Standards Association (VICS)

Nigel Bagley, Unilever

John Clarke, Tesco

Colin Cobain, Tesco

Friso Coppes, Ahold

Ann Dozier, Coca-Cola Enterprises

H. James Dallas, Georgia-Pacific Corporation

Ashraf Eisa, Wal*Mart Stores

Lou Farina, Mars, Incorporated

Jim Flannery, The Procter & Gamble Company

Alain Galaski, European Brands Association (AIM)

Dirk Heyman, The Gillette Company

Peter Jordan, Kraft Foods

Duane Judd, Nestlé

Zygmunt Mierdorf, METRO Group

John Phillips, PepsiCo

John Raudabaugh, Albertsons

Katrin Recke, European Brands Association (AIM)

Sabine Ritter, Global Commerce Initiative (GCI)

Andy Robson, CHEP

Randy Salley, Wal*Mart Stores

Pamela Stegeman, Grocery Manufacturers Association (GMA)

Tony Taylor, EPCglobal

Milan Turk, Jr., The Procter & Gamble Company

Pat Walsh, Food Marketing Institute (FMI)

Robert P. Wilkinson, The Coca-Cola Company

Dr. Gerd Wolfram, METRO Group

Elizabeth Yagle, Albertsons

Special thanks are due to the IBM Business Consulting Services team of Keith Alexander, Adam Beales, Sean Campbell, Julian Chu and Sachin Shah.

This work was supported, in part, by the IBM Institute for Business Value, which develops fact-based strategic insights for senior business executives on critical industry-specific and cross-industry issues. The IBM Institute for Business Value is part of an ongoing commitment by IBM Business Consulting Services to provide analysis and viewpoints that help companies realize business value.

It is understood that each company faces different circumstances and may have different objectives, and so this report is not intended to be used to direct implementation of EPC in any particular context. Readers should seek individual, specific advice on what would be relevant for their companies. The report's authors do not imply nor commit that the information contained herein should be exclusively relied upon to develop individual company strategies or make decisions.

2. Executive Summary

This report represents a joint assessment by GCI members, including representatives from both the manufacturer and retailer communities. Our aim is to provide senior industry leaders with pragmatic insights on how RFID technology and the EPC can help drive major changes in the industry supply chain that lead to benefits for all participants. It builds upon the GCI's previously published "EPC Roadmap" (November 2003) to provide:

- An updated vision for EPC adoption in the consumer products/retail industry
- Scenarios explaining the transformational potential of EPC technology that can be exploited through changes in business processes, within and across trading partners
- Steps that individual companies, trading partners and the industry as a whole need to take to move toward the vision of EPC-enabled supply chains.

2.1 A Shared EPC Vision

Leading retailers and manufacturers share the ultimate vision of an EPC-enabled supply chain that brings significant service and efficiency benefits to shoppers, end consumers and businesses. The EPC-enabled supply chain will enable trading partners to meet shopper and consumer needs in ways far superior to what is possible today.

EPC is a global-standards-based implementation of RFID technology, supported by the use of standards-based tags, readers, tag content and information flows. It can be viewed as a continuation of the journey which began some 25 years ago with the

introduction of barcode scanning, though EPC makes a significant step forward with the ability to support mass serialized identification. While barcode implementation has delivered significant benefits to both the shopping experience and industry supply chain efficiency, great opportunities remain for further innovation and improvement in both areas.

As explained in Chapter 3 of this report, successful implementation of the technical capabilities introduced by EPC makes it possible for companies to have broad, relevant and real-time information about product movement across the supply chain, from upstream suppliers through manufacturers, third-party logistics and distributors, to the retail store. In the near and medium term, case- and pallet-level tagging has the potential to significantly improve supply chain visibility, which will lead to **increased collaboration and operating efficiency** for supply networks based on both distribution centers (DC) and Direct Store Delivery (DSD). These capabilities are expected to deliver significant benefits to shoppers, end consumers and industry adopters in the following areas:

- Store operations and replenishment
- Distribution Center operations
- Logistics asset control
- Total inventory management
- Track and trace
- Shelf replenishment-shelf availability
- Goods transfer
- Promotion/event execution
- Shrink management.

And when item-level tagging becomes feasible in a given product category, shoppers will benefit from an **enhanced shopping experience** with even better on-shelf availability, fresher products, more efficient checkout, and improved service and information delivery.

2.2 Top-Level Conclusions

EPC adoption is happening today, as leading companies actively pilot and deploy EPC initiatives addressing many of the areas listed above. **It is, however, very much a work-in-progress.** While we have made significant advances in understanding how EPC can be used to drive anticipated benefits, we still have much to learn.

Thus, GCI commissioned this report to share the recent learnings and perspectives of leading EPC adopters with the rest of the industry and the market at large. Our key conclusions are discussed below (and summarized in Figure 1), followed by recommended industry actions.

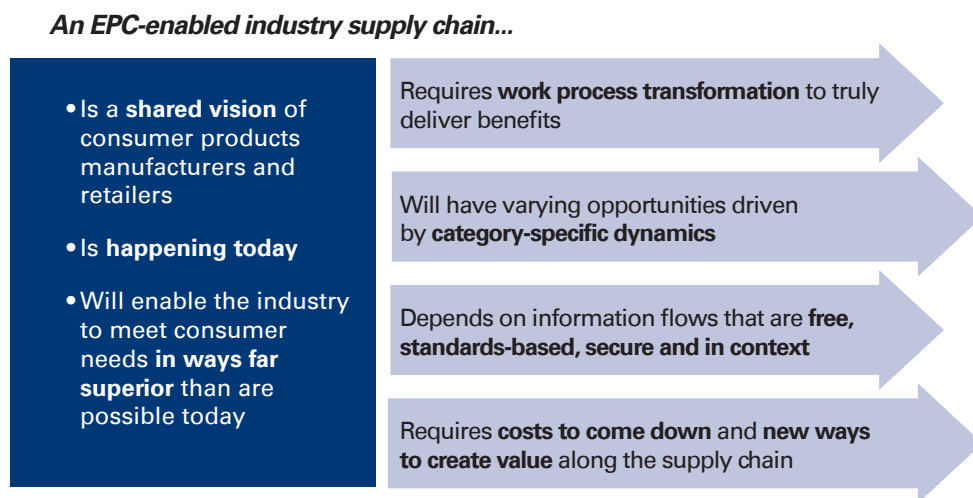
Work process transformation is required for EPC to truly deliver benefits.

Leading adopters generally expect four primary sources of benefit from EPC adoption in the near to medium term:

- Increased sales from improved on-shelf availability
- Reduction in inventory levels
- Improved labor productivity in stores and distribution centers
- Reduction in post-sale transaction and administrative costs (e.g., claims).

However, to fully realize these anticipated benefits from EPC adoption, trading partners must simultaneously pursue both process and technological changes. These benefits are dependent on companies making requisite changes in business practices and work processes, both internally and in collaboration with trading partners. Chapter 4 of this report examines and highlights key features of process transformation in the most important scenarios across all store categories.

Figure 1. Top-level conclusions of this report.



Source: Global Commerce Initiative.

Category-specific dynamics drive differences in opportunity.

With respect to EPC adoption, different product categories have different dynamics including cost structures, required infrastructure support, distribution models, value to the consumer and role in the retail store. This report was prepared by manufacturers and retailers involved in the production, sale and merchandising of many categories of consumer products. The recognition of category dynamics as a key driver of the business opportunity in EPC adoption is reflected in the Industry Action Plan (Chapter 5), including the need to "learn by doing" and to pilot in categories which reflect the greatest opportunities based on mutual trading partner business cases.

Trading partner collaboration is dependent on information flows that are free, standards-based, secure and in context.

Process change of any kind is difficult and even more so when it requires coordinated action across trading relationships. To enhance the likelihood of success, trading partners need to operate off of the same information. Therefore, it is essential that *industry participants have a fundamental willingness to collaborate and share supply chain information with trading partners.* Progress must continue in establishing accepted "best practices" for the sharing of important information among trading partners in order for EPC to truly work and for the industry and end-consumers to benefit.

Costs must come down and new ways to create value along the supply chain must be found.

In addition to the transformation of specific work processes, a key driver of EPC's potential benefits is the value of the pallets and cases being tagged relative to the cost of the EPC tags and the RFID infrastructure.

Collaboration among early adopters, industry participants, technology vendors and EPCglobal will be required to continue improving EPC's cost of implantation and overall value proposition – the ability to deliver consumer benefits ultimately depends on the reduction of these costs. Several steps addressing this point are proposed in the Industry Action Plan, including the following in particular:

- Focus by individual companies on understanding their specific business case
- Completion of meaningful pilots by trading partners
- Recognition by the industry of the key technology improvements which are needed.

Learning from the Barcode Experience

To better understand the long-term context for EPC and help us predict its key success factors and likely challenges, the industry should review lessons learned in the adoption of the barcode, a process with many similarities. Time will tell whether EPC adoption patterns will mimic that of the barcode, but the lessons learned (discussed at the end of Chapter 3) should be heeded as we tackle the new opportunities enabled by EPC.

In particular, the industry's historical experience with barcodes illustrates the importance of:

- Developing and adopting truly global standards
- Open sharing of information among trading partners
- Active collaboration on required business process changes
- Continued monitoring of actual versus forecasted costs and benefits to update business case projections.

2.3 Required Industry Actions

The final chapter of this report outlines the key actions recommended by the GCI for individual companies, trading partners and the industry as a whole. They are listed here in brief:

Action Steps for Individual Companies

1. Understand and communicate the EPC vision within your own organization, setting up a cross-functional team and identifying an executive-level champion.
2. Learn by doing – Conduct your own business case analysis, and experiment with and investigate opportunities for using EPC in your own company.
3. Ensure your company has clean, accurate product data that is aligned with trading partners and being shared automatically with those trading partners (through Global Data Synchronization, a recognized industry best practice).
4. Participate in and support industry groups, especially EPCglobal, at local, regional or global levels to share learnings and engage in the standards-setting process.
5. Understand and proactively address the consumer and public policy perspectives on EPC.

Action Steps for Improved Trading Partner Collaboration

6. Embrace the exchange of supply chain information and collaboration via the EPCglobal Network as a source of business improvement, not as a threat. Establish clear information-sharing work practices with your trading partners and support the use of free, standards-based information exchange.
7. Engage in meaningful pilots with trading partners, focusing on opportunities identified in mutual business cases.

8. Leading adopters should share their knowledge, experience and findings more widely in industry forums, including information on pilot results and business value.
9. Manufacturers and retailers should collaborate to craft a workable roadmap for EPC deployment focusing on high potential categories and the most accessible supply chain opportunities.
10. Upstream suppliers and third-party logistics and distribution service providers should keep pace with industry adoption to avoid creating gaps in the capabilities of the end-to-end supply chain.

Action Steps for the Industry as a Whole to Address Critical Technology Issues

11. Industry participants should work with EPCglobal to prioritize the development of future requisite regulations and standards, such as tag classes, software interoperability and data sharing, that can be globally accepted and adopted.
12. Industry participants, technology vendors and EPCglobal should work together to make required capabilities available to drive expected benefits. Focus areas should include: improved tag read rates and accuracy, high-speed tag application and embedding technology, a scalable EPC information network, and a conformance and performance certification process.

In summary, EPC implementation is a substantial investment that requires in-depth, joint planning. Trading partners need to figure out the best path to an EPC-enabled value chain, working together to determine how they can deploy EPC in an economically viable way to achieve an end-state that drives lasting value.

3. The EPC Vision

While this report focuses primarily on case- and pallet-level EPC tagging in the near and medium term, it is important to place this discussion in a broader, long-term context. In this section, we first examine the overall future vision of an EPC-enabled supply chain and shopping experience and EPC's place in the evolution of the industry.

3.1 EPC: The Next Wave

The consumer products/retail industry has long taken advantage of new digital technologies to transform its operations. Going back to early mainframes in the 1950s, through the adoption of the barcode and electronic point-of-sale (POS) devices in the 1970s, up to more recent innovations such as electronic data interchange (EDI) and Internet-based commerce, successive waves of new technologies have helped companies better manage operations and improve service to suppliers, customers and consumers.¹

RFID technology, and, in particular, the standardized EPC and its associated information flow via the EPCglobal Network, are poised to enable the next wave of evolution in the way manufacturers, retailers and their business partners share information and work together to satisfy consumer demand. **EPC can be thought of as an extended barcode containing a serialized item key that enables individual products to be uniquely identified.** Unlike existing barcode technology, EPC systems, based on the use of radio frequencies, do not require line-of-sight scanning. This fundamental change improves the speed and potential accuracy of data collection and provides the following new capabilities:

- **Faster scanning and product handling**, with the capability to support hundreds of tag "reads" per second (versus one-at-a-time as with barcodes) and to conduct automated scanning with limited manual intervention
- **New opportunities to collect inventory information and "see" the flow of products**, potentially in real time and in locations not previously feasible across the supply chain and in the store
- **Automated "triggering" of appropriate actions** (e.g., replenishment orders, stock alerts) with less manual intervention
- **Identification of discrete items**, for example by flagging duplicate or invalid codes, thus enhancing the execution of promotions, track and trace, product authentication and other activities.

These new capabilities will become fully realized as EPC technology matures. Today, however, many pilots have encountered technological challenges with:

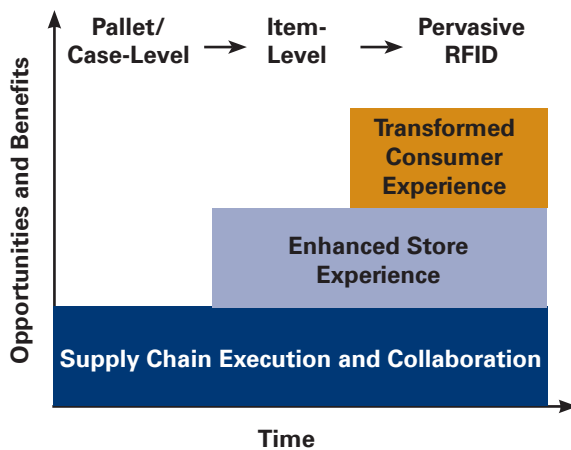
- Tag quality (significant percentage of defects)
- Inconsistent read rates (due to issues with tag placement, the physics of the product or environment, and the compatibility of tags and readers)
- Tag application equipment (inability to operate at sufficient speed and volume with consistent quality).

Through current testing and initial deployment efforts, technology vendors and users are working to overcome these challenges and make effective use of the current level of performance. At this time, for example, the read rates differ when

reading all cases on a pallet compared to reading individual cases on a conveyor system. While, in some pilots, 100 percent read rates *are* being achieved, results vary greatly depending on product characteristics and environmental conditions.

Nonetheless, over time, EPC has the potential to bring fundamental change to many areas of the marketplace, from the supply chain to store operations to consumer interactions. The nature of EPC adoption will necessarily evolve as new systems and standards are developed, technology costs come down and new insights are developed on how it can add value. The likely evolution of EPC adoption is illustrated in Figure 2.

Figure 2. Envisioned evolution of EPC adoption.



Source: IBM Institute for Business Value.

Today, most companies are focused on implementing EPC in the supply chain at a pallet and case level, to improve operational efficiency and trading partner collaboration. The ultimate goal is to provide consumers with greater value and a better shopping experience through fewer out-of-stocks, fresher products and better service in the store. Going forward, we envision that

companies will use EPC tags at the item level and the point of sale to enhance the store experience. Ultimately, consumers may benefit from EPC-enabled capabilities throughout a transformed consumer experience. (In fact, a few companies are already exploring stages 2 and 3 today. In addition, for bulk products such as pet food or electronics, "case-level tagging" could encompass the consumer saleable unit.) The following sections provide an overview of these three stages of EPC adoption.

3.1.1 Supply Chain Execution and Collaboration

The focus for most companies and in most product categories today is on pallet- and case-level tagging. Even at this level, EPC adoption can lead to a better consumer shopping experience by enabling companies to improve supply chain execution and collaboration. (Note, however, that some companies are also actively exploring inner-pack and item-level tagging of products such as medicines, cosmetics, consumer electronics, CDs/DVDs and apparel, to address category or brand-specific business needs and because immediate benefits can be delivered.)

To help frame the breadth of potential EPC applications, we have classified the major EPC opportunity areas within the supply chain into six categories:

1. **Store Operations**
2. **Distribution Operations**
3. **Direct Store Delivery**
4. **Promotion/Event Execution**
5. **Total Inventory Management**
6. **Shrink Management.**

The next chapter explores in detail scenarios for transforming work processes in these six areas.

Industry leaders have also identified further opportunities to enhance supply chain execution and collaboration through EPC adoption, although more work is required to understand its potential applications and benefits in these areas. For example, EPC holds promise in a range of "track and trace" activities:

- **Anti-Counterfeiting**
- **Product Diversion**
- **Recalls/Reverse Logistics²**
- **Fresh/Code-Dated Product Management**
- **Temperature/Cold Chain Monitoring³**
- **Legal Compliance.**

In addition, three major areas of EPC supply chain opportunities remain largely unexplored in the consumer products/retailing industry today:

- **Manufacturing Operations** – While some companies have already achieved significant improvements in this area through barcode-based systems, further EPC-enabled benefits may be possible. For example, manufacturers could use the better demand signal visibility enabled by EPC to improve capacity planning and production efficiency for both themselves and key subcontractors and co-packing partners. EPC could also help manufacturers improve tracking and management of work-in-process inventory; maintenance, repair and operating (MRO) supplies; and spare parts.
- **Upstream Supplier Management** – EPC may also help to improve replenishment and inventory management further up the supply chain, specifically with raw materials and packaging suppliers. Track and trace initiatives have the potential to support "recipe management" and lot-tracking activities, where inbound materials are tracked through the manufacturing process and linked to production orders and finished goods.

- **Transportation and Logistics** – RFID tagging of shipping units (trucks, containers, railcars, etc.) will improve transportation management. As one example, the fast-track tagging of "known trucks" (with contents notified in advance) will reduce the need for debriefs and gatehouse personnel. Waiting times at the ramp will decrease due to quicker unloading processes and better scheduling of arrivals. Knowing where shipping units are located at any time provides for better asset utilization, leading to benefits in third-party logistics (3PL) and indirect benefits throughout the supply chain.

It should be noted that some companies are exploring ways of realizing supply chain benefits without the use of EPC, through data synchronization and other collaborative process changes involving the retailer (e.g., Serial Shipment Container Code [SSCC], Advanced Shipment Notification [ASN] or Despatch Advice [DESADV], and Evaluated Receipts Settlement [ERS] or Receipt Advice [RECADV]).

3.1.2 Enhanced Store Experience⁴

Looking further out, the broader vision for EPC is to tag individual products at the item level. While technology costs remain too high in our industry to make this feasible in the near term for most product categories, these costs will inevitably come down as EPC adoption scales across various industries including consumer products/retail. As this occurs, consumers will likely see increased value and noticeable enhancements to the shopping experience, enabled by new supply chain and store management practices. For example:

- Product out-of-stocks would become very rare, as "intelligent," EPC-capable store fixtures provide retailers and manufacturers with stock visibility all the way to the shelf and enable more dynamic restocking procedures.



- The assortment and presentation of products would be more aligned with consumer shopping preferences, as EPC data is used to improve category management and automated shelf-level monitoring helps ensure compliance with plan-o-grams.
- Shoppers would only see “fresh” products available for purchase, as item-level stock monitoring helps retail employees quickly and efficiently identify aging or obsolete products that should be removed from the sales floor.
- Store employees, with access to item-level product inventory information, could quickly help a customer find a specific size, color or model anywhere in the store or throughout the retail chain.
- Consumers could obtain valuable information that helps them make better shopping decisions (for example, product features, usage instructions and promotions on complementary products), through digital displays or information kiosks that interact with EPC-tagged products.
- The checkout process would no longer be a primary source of consumer pain, as EPC-tagged products make possible rapid, automated tallying of purchases.

3.1.3 Transformed Consumer Experience

EPC might ultimately become pervasive throughout the consumer environment, as a wide range of consumer devices become capable of interacting with tagged products. Glimpses of potential future applications can be seen today in other markets, such as RFID-based toll collection systems for automobiles and identification systems for pets. As successive generations of EPC technology are developed and deployed, they will likely become the basis of as-

yet unimagined shopping experiences and product/service offerings. While it is difficult to predict with certainty what new applications and services will emerge, the successful ones will surely be those that respond best to consumers’ needs.

Industry participants recognize that this vision for bringing innovation and added value to the consumer shopping experience is a long-term effort and that companies should continue to support the EPCglobal “Guidelines on EPC for Consumer Products” going forward.⁵

3.2 Learning from the Past: The Barcode Experience

To understand better the long-term context for EPC, the industry can review lessons learned in the adoption of the barcode, a process with many similarities to that of EPC. Four key aspects of this experience can help us understand the likely road ahead for EPC:

3.2.1 Standards are critical to drive widespread adoption.

By accepting common standards, such as product code specifications and the graphic design of the barcode itself, companies were able to invest in the required new technologies with confidence that their barcoded products and scanning systems could be used with any trading partner in the industry. Technology vendors could focus on application and functionality innovation knowing they had chosen the right platform to build upon.

While there were some local variations, this was not a major issue at a time when trade was more “local” than “global”. The EPC initiative has the opportunity to avoid this shortcoming by moving to one global set of standards from the start.

3.2.2 Collective industry action is key to achieving critical mass and speeding realization of benefits.

Supply chain technologies inherently face implementation challenges because they typically involve high initial costs and long-term, gradual benefits. Companies prefer to have assurances that a large percentage of their trading partners are going to adopt compatible systems and business processes before committing to large-scale deployments.

In an industry environment more fragmented than today, the barcode initiative faced several daunting challenges. Three things had to occur simultaneously:

- Persuading manufacturers that enough retailers would adopt scanning technology to make their investments worthwhile
- Assuring retailers that sufficient numbers of suppliers would source-mark their products with barcodes
- Convincing technology vendors that adequate industry demand would materialize to justify their R&D investments.⁶

The group of industry executives that advocated barcode adoption focused heavily on this critical mass problem and personally worked to build support across the industry. However, it wasn't until the vast majority of products were barcoded that a significant number of retailers adopted scanning systems. In today's more consolidated competitive environment, a comparatively smaller number of retailers will be sufficient to achieve a critical mass of EPC-enabled product flow.

3.2.3 Full realization of benefits requires open information sharing and sustained change in business practices and processes.

Companies achieve benefits not simply by deploying new technology, be it data processing, the Internet, or RFID, but by implementing changes across and within business processes to exploit the new capabilities available. In many areas, including those targeted by EPC, this requires coordinated change on the part of multiple trading partners and participants in the industry value chain.

The historical experience around barcodes illustrates this critical point: Many of the expected benefits were based on the premise that manufacturers and retailers would cooperate and share POS data to better manage cross-company activities like replenishment, inventory management and shrink control. Some of these opportunities were partially, but not fully, achieved, and others remain completely untapped.⁷

3.2.4 Forecasting benefits and costs is difficult.

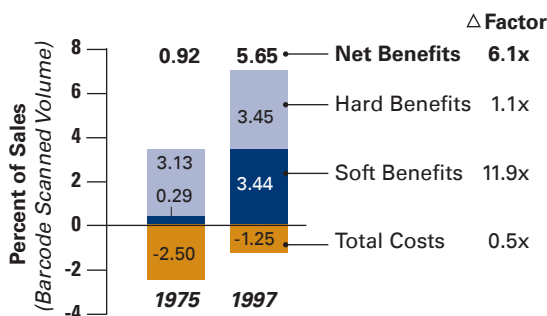
At an early stage in the adoption of any technology, quantification of benefits and costs are subject to many uncertainties. That is the case today with EPC. In such an environment, companies may be conservative in their estimates. Focusing on tangible costs and benefits, initial business cases may underestimate the technology's full impact.

The barcode experience provides a clear case in point. Startling results came from a comparison of the original business case for barcode adoption in the U.S. grocery industry with estimates of the actual impact over 20 years later (see Figure 3). Two key conclusions stand out:



First, the originally projected costs of adoption were *twice* as much as the actual costs, as technology prices dropped more quickly than anticipated. As can be seen in the evolution and introduction of many technology-based goods (think DVDs and mobile phones versus televisions or VCRs), price/performance improvements are accelerating and adoption cycles compressing.

Figure 3. Estimated barcode scanning benefits, 1975 vs. 1997.



Note: "Hard benefits" refers to measurable cost reductions in areas such as checkout and price-marking labor, checkout losses and bookkeeping. "Soft benefits" refers to gains in areas such as inventory reduction, shrink control, sales lift and improved warehouse operations.

Source: Nelson, John E. and Vineet Garg. "17 Billion Reasons to Say Thanks: The 25th Anniversary of the U.P.C. and Its Impact on the Grocery Industry". PricewaterhouseCoopers, 1999.

Second, the benefits were drastically underestimated, with the eventual net benefits in 1997 amounting to six times the original projection (expressed as a percent of barcode-enabled sales). In particular, the soft benefits realized by 1997 have been estimated at 12 times the original projection (again, in terms of percent of total barcode-enabled sales). To some degree, this was done purposefully – the initial projection of soft benefits was discounted *75 percent* to make it an easier case to sell to the industry.

And because barcode scanning was adopted much more widely across the industry than expected, the impact in absolute dollar terms has been orders of magnitude larger than originally forecast.⁸

Time will tell whether EPC adoption patterns will mimic that of the barcode, but the lessons learned should be heeded as we tackle the new opportunities enabled by EPC.

In particular, the industry's historical experience with barcodes illustrates the importance of:

- **Developing and adopting truly global standards**
- **Open sharing of information among trading partners**
- **Active collaboration on required business process changes**
- **Continued monitoring of actual versus forecasted costs and benefits to update business case projections.**

4. Exploiting EPC's Full Potential: Scenarios for Transformation

The full impact of EPC will not be achieved simply by deploying technology into today's supply chain processes. While some product categories appear to have characteristics that afford a clear path to economic returns, the full scope of benefits may not be as obvious or immediate in other categories. Therefore, to achieve EPC's full potential, manufacturers and retailers need to understand what it will take to achieve currently identified benefits and to explore ways of further exploiting EPC-generated data to expand the benefit potential and improve the long-term return on investment.

Leading companies are actively investigating these opportunities across the industry supply chain, all of which will require companies to "rewire" their existing processes, systems and business practices. To share and deepen knowledge across the industry and to focus attention on the most important opportunities and issues, this section explores six scenarios for EPC-enabled transformation based on case- and pallet-level tagging (see Figure 4), highlighting the following for each:

- *Where's the pain* – Identification of today's business practices and problems
 - *What's possible* – A detailed description of future EPC-enabled processes
 - *What's the impact* – The anticipated economic benefits from EPC adoption in these areas
 - *What needs to change and who needs to take action* – The key implementation requirements across people, processes and technology systems; areas of responsibility across different participants in the industry value chain (e.g., manufacturers, retailers, logistics providers, etc.); and the expected timeframe for implementation.
- The performance of the RFID technology (e.g., tag yields and read rates, tag application speed and reliability) is adequate for the applications described.
 - Trading partners are using accurate, synchronized item data and sharing EPC-generated product movement information.
 - The requisite standards are available and being used.

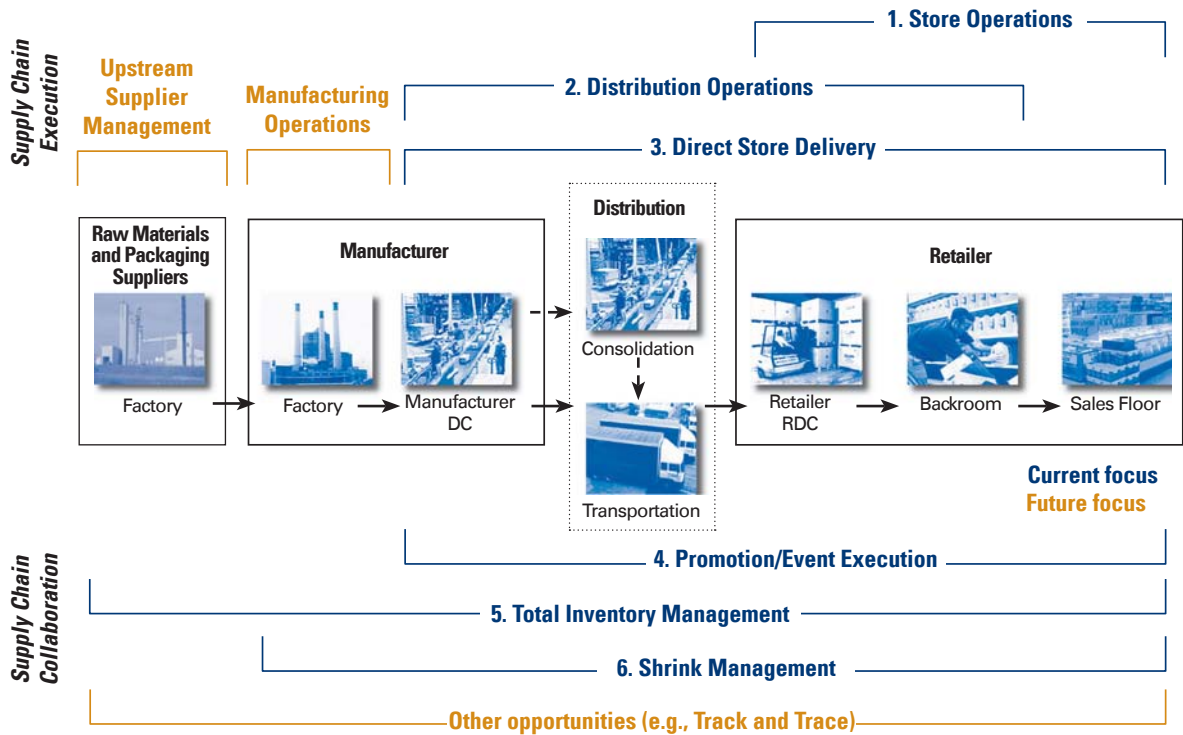
While companies in the industry are also exploring ways of improving supply chain performance using existing technology (e.g., barcodes or EDI), **EPC brings a new set of capabilities that can enable more effective approaches to these challenges.** Figure 5 summarizes key differences between barcode and EPC-based capabilities in different aspects of the supply chain.

Note that all of the scenarios presented in this report generally assume the ability to achieve tag read rates approaching 100 percent of both cases and pallets. This is currently not always possible with the maturity of the technology today, particularly due to issues with the physics of reading full pallets of products containing metals, liquids and metallized films. Many of the new business processes described in these scenarios require the ability to identify all cases on a pallet to enable transformational changes in accuracy and material handling. It should be noted that 100 percent read accuracy is not necessarily required to obtain some of the benefits, as process workarounds can help compensate for gaps. In addition, these scenarios generally assume the following:

Further, it is important to note that these scenarios depict fully enabled EPC processes and operations, not interim processes and solutions that companies may need

to deploy to manage duplicate or hybrid processes for both tagged and non-tagged pallets and cases.

Figure 4. Major EPC supply chain opportunities across the industry value chain.



Source: IBM Business Consulting Services.

Figure 5. Comparing EPC versus barcode-based capabilities.

Illustrative Supply Chain Capabilities	Effectiveness		Comments
	Barcode	EPC	
Confirm store-level promotion/display compliance and product staging	○	●	<ul style="list-style-type: none"> EPC readers on door to store floor confirm movement of displays/promoted products to sales floor. Other readers confirm staging quantities in backroom and DCs. Use of barcode scanners to track case movements at doorways not practical. Serialized EPC enables tracking of specific promotions through supply chain, something which global trade identification number (GTIN) allocation rules may currently prevent.
Automate store inventory tracking upon store receipt	○	◐	<ul style="list-style-type: none"> Scanning barcodes on products received is not always practical, given receipt volumes and labor requirements. Current store labor model does not allow for cost-effective barcode scanning of all receipts. With EPC, all receipts can be automatically logged, helping to eliminate stock file inaccuracies and enable more effective replenishment.
Enable store backroom pick lists	○	●	<ul style="list-style-type: none"> Comparing data on case movements to sales floor with POS data could help identify potential out-of-stock situations. Alerts could trigger pick lists for backroom employees. Barcode scanning not practical at door from backroom to sales floor.
Locate products more efficiently in the backroom	○	●	<ul style="list-style-type: none"> Handheld readers could be programmed to help search for needed cases (requires alerts from store systems). Barcode-based search requires line of sight and is not practical for searching large areas for needed stock.
Out-of-hours receipt of Direct Store Deliveries	◐	●	<ul style="list-style-type: none"> EPC enables automated verification of receipts without presence of store employee. Use of barcodes would require either store or DSD employee to manually scan products.
Gain visibility to inventory across company boundaries and operations	○	●	<ul style="list-style-type: none"> EPCglobal Network aims to provide case/product visibility across trading partners. New reader locations will track product movement automatically and provide new visibility. Scanning barcodes can also provide this visibility, but it is not always practical to widely deploy people and equipment to do the scanning (e.g., at door to sales floor, on forklifts, trucks, etc.). EDI and associated transactions such as ASNs have, to some extent, provided greater visibility.
More automated manufacturing and distribution operations	◐	●	<ul style="list-style-type: none"> Barcodes have already enabled a significant degree of automation in both manufacturing and distribution. Early trials indicate that EPC provides more advanced automation capabilities.
Monitor shelf stock levels (future “smart shelves”)	◐	●	<ul style="list-style-type: none"> Item-level EPC tagging and shelf readers can monitor shelf levels without human intervention. Able to establish automated triggers and alerts to proactively identify low stock levels. Barcodes would require manual shelf inspection/line-of-sight scanning.

○ Low → ● High

Source: GCI and IBM Business Consulting Services analysis.

The first set of transformation scenarios focuses on improved execution of core supply chain activities through EPC enablement. Many of the capabilities developed and deployed in these areas provide the critical foundation for future benefits that could be achieved through improved supply chain collaboration.

4.1 Store Operations

This scenario covers store receipt of products from retail distribution centers ("store replenishment") and the movement of products within the store itself ("shelf replenishment").

4.1.1 Current Issues

EPC-enabled store and shelf replenishment practices can address many of the problems retailers and manufacturers face today that cause out-of-stocks⁹ and limit the time store employees spend serving customers, such as:

- **Inaccurate receiving into the backroom** – "Blind received" deliveries provide no guarantee of receipts.
- **Poor/lengthy check-in routines** – The alternative to blind receiving is to take the time to manually check product. Store employees may spend excessive time correcting internal IDs for received product. For example, product arrives at the store, but the GTIN is not in the system or is inaccurate (due to faulty data entry at corporate). Store operations are disrupted, as the product cannot be sold until a category or store manager corrects the error.
- **Actual versus book stock inventory discrepancies.**

- **Excessive time spent on inventory counts and searching for products.**
- **Distorted and delayed store demand signals** – Unable to find a given product in cluttered backrooms, store employees may incorrectly "zero out" store stock information, leading to unnecessary orders.
- **Inflexible or arbitrary replenishment routines** – Employees work according to a fixed timetable instead of in response to actual customer demand and shelf conditions (for example, "cheeses at 10 AM, detergents at 11 AM").

4.1.2 Process View

With EPC enablement, both retailers and manufacturers believe that store employees will have more capability to improve inventory accuracy, track product movement from the backroom to the sales floor, find products in the backroom more readily and, ultimately, better manage shelf replenishment to improve product availability (see Figures 6a and 6b).

- **Efficient and accurate store deliveries** – When products are received at the store, an EPC-enabled process can identify case receipts and update the store inventory system. In addition, with new software functionality, receipts could be compared to expected deliveries to validate that the right goods were delivered to the right stores and identify any overages or shortages. Discrepancies would automatically generate "alert" messages to inform delivery and receiving personnel, who would also have an "override" capability to handle damages and breaches. Improved

delivery accuracy is thus obtained without increasing labor requirements. In fact, turnaround times should become shorter, and deliveries should consume less driver and store staff time.

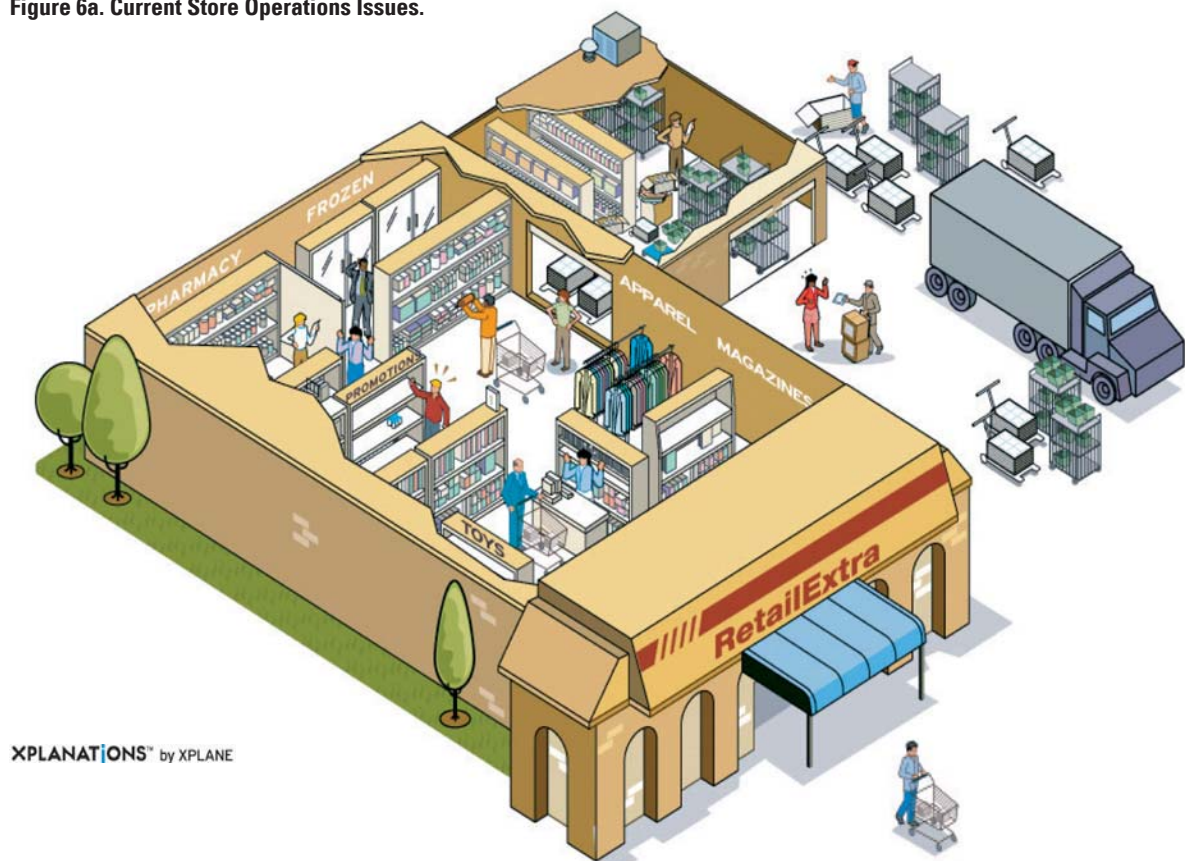
- **Segmented stock monitoring (between the backroom and sales floor)** –The store's book stock system would become significantly more accurate, as inbound deliveries cause this information to be updated automatically. And with EPC readers located at the doors between the backroom and the sales floor, stock levels in each part of the store can be monitored separately. Additional EPC readers at the compactor, baler or waste area (depending on how the store handles emptied cases) help to verify that cases brought to the sales floor were actually emptied, and when. It is generally believed that retailers will see improved store-level inventory accuracy, providing a better foundation for store execution processes and systems.
- **Demand-driven replenishment** – Improved inventory accuracy on its own should improve store replenishment practices and the timing and quality of orders placed with the distribution center. With improved accuracy and visibility, store employees would also have greater confidence when looking for a particular item and be able to locate products more quickly with the creation of new backroom management processes. Retailers could also implement a variety of alert-based practices to improve shelf replenishment. For example, they could compare existing electronic POS data with product movement to the sales floor and proactively generate alerts for employees

to investigate shelves that are believed to be running low on stock. Emergency orders could be classified for immediate handling, enabling "fast-track" movement to the sales floor upon receipt.

With future reader technology, alerts might be directed to handheld readers that act more like locator devices to help employees locate specific EPCs and cases in the backroom. The result is proactive shelf replenishment that is more in line with consumer demand, to help avoid intra-day or peak-hour stock-outs. Employees can then replenish a greater number of shelves in less time and focus more effort on items most in danger of being out of stock.

- **Improved administrative efficiency** –With greater visibility to stock levels in the backroom and sales floor, store employees would spend less time performing routine tasks such as product counts and rotation of fresh or code-dated products (and/or do them less frequently). EPC numbers could be linked to product expiration information at manufacturer tagging points, or even within the retail distribution process all the way up to the shelf, to help identify soon-to-expire products more efficiently.
- **Improved yard security and inbound management** – Receiving doors could be secured with EPC readers to improve management of and control over product cases and delivery assets. With future tag technology (potentially making use of "active" instead of "passive" tags), transport carriers and trailers may include identification devices that are linked to the contents of the shipment to help retailers prioritize trailer unloading.

Figure 6a. Current Store Operations Issues.



XPLANATIONS™ by XPLANE

Backroom:

- Prevalence of “blind receiving”
- Inaccurate store inventory
- Difficulty finding products for shelf replenishment
- Inefficient stock rotation

Sales Floor:

- Inaccurate stock information
- Poor on-shelf availability (difficult to find products and predict out-of-stocks)
- High labor cost for product counts/searches; time not spent serving customers
- Arbitrary replenishment routines not aligned with actual demand

Store Deliveries:

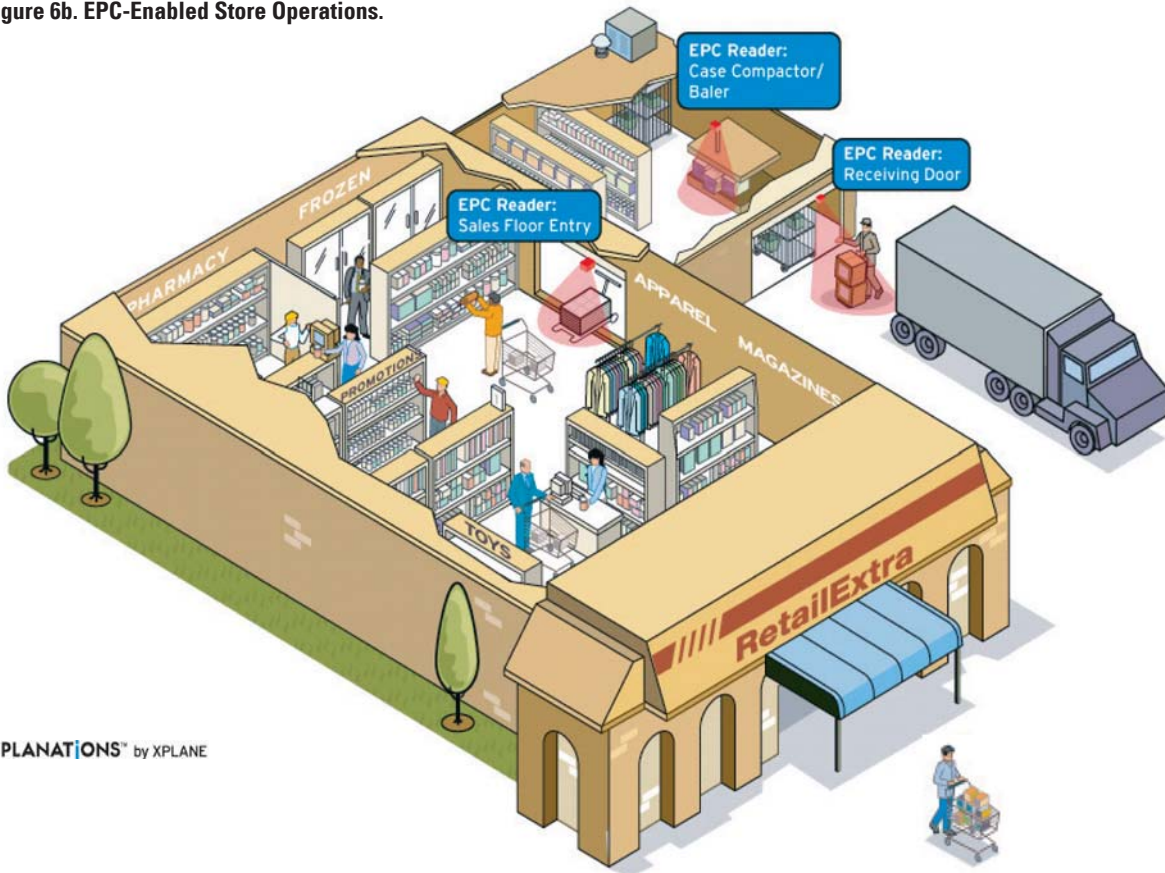
- Errors made in multi-drop deliveries (wrong product, wrong store)
- Poor checking routines (high labor cost, bottlenecks)
- Excessive time spent correcting internal data for received product

Yard:

- Unsecured receiving doors
- Unauthorized product/asset movement (including theft)

Source: IBM Business Consulting Services analysis; Graphics by XPLANE.

Figure 6b. EPC-Enabled Store Operations.



XPLANATIONS™ by XPLANE

Backroom:

- Verified “hands free” receiving, with alerts for discrepancies
- Accurate stock information
- Better stock location management
- Improved stock rotation

Sales Floor:

- Accurate stock information
- Improved on-shelf availability
- Reduced administrative activities
- More efficient, event-driven replenishment

Store Deliveries:

- Improved delivery accuracy
- Reduced congestion/improved turnaround times
- Better labor/asset utilization

Yard:

- Secure receiving doors
- Better product/asset control and returns

Compactor/Baler/Waste Area:

- Reader to confirm that cases were emptied and removed from the stock file

Source: IBM Business Consulting Services analysis; Graphics by XPLANE.

4.1.3 Economic Benefits

In the ways described earlier, EPC enablement can help **drive revenue growth** for both manufacturers and retailers and **improve retailer productivity** through more efficient labor utilization. The retailer could choose to refocus store staff on promotional, merchandising and other more customer-facing, revenue-generating activities. Consumers would enjoy better service from store employees and, in general, have greater assurance that the products they want to buy are in stock and "fresh".

4.1.4 Implementing the Vision

Most of the requirements to realize this store operations vision will be the responsibility of retailers to implement (see Figure 7). They may also require significant changes in technology and store work processes, such as the following:

- Retailer DC systems able to validate "right product, right store" delivery accuracy upon shipping and/or store readers and systems able to validate deliveries upon receipt
- A store book stock system capable of receiving inventory updates from EPC readers and able to track stock information for the backroom separately from the sales floor
- Store managers and employees changing their approach to labor management and shelf replenishment to respond to "imminent" out-of-stock alerts.

Retailers that already possess some form of the required capabilities, such as an out-of-stock alert system based on POS data or a delivery system that makes use of electronic shipment notifications, can begin integrating EPC-based information into these systems to enhance existing processes. They can work with key suppliers and logistics service providers to identify which legacy systems need to be modified to support EPC and determine how stock information can best be shared among them (and to what ends). Companies without these capabilities will need to start building them.

After basic changes are made to store receiving and replenishment processes, retailers and manufacturers would be able to develop new business practices to take greater advantage of EPC-generated information – for example, in overall store management, other areas of stock management, supplier sales force deployment and promotion/event execution (see "Promotion/Event Execution" scenario). Product movement data could also be shared with suppliers as an input to improve manufacturer replenishment processes (see "Total Inventory Management" scenario).

Improved on-shelf availability and increased sales brought about by EPC-enabled store operations are key benefits expected by both manufacturers and retailers. But it is an area largely dependent on retailers making the necessary investments and changes across their stores. Trading partners, thus, need to know the timing of expected store process changes and benefits.

Figure 7. Store operations: Key implementation requirements.

	Description	Responsible Party				Timescale
		Raw Mat'ls Supplier	CP Mfr.	3PL	Retailer	
People/ Process	• Develop new receiving procedures and policies for handling mixture of tagged and non-tagged SKUs				✓	Short term
	• Define detailed procedures and policies for moving tagged cases from backroom to sales floor and for case disposal in trash compactors				✓	
	• Develop exception processes and policies to handle partial or incomplete reads and/or partial case movements				✓	
	• Develop reporting or "traceability" mechanism to validate EPC reads from receiving through sales floor to case destruction at compactor				✓	
	• Define and train store employees on new EPC-driven, and potentially more frequent, backroom management and replenishment processes				✓	
	• Define general store procedures, policies and priorities for managing tagged vs. non-tagged cases				✓	
System	• Modify store receiving systems to enable automated reconciliation between expected and actual receipts				✓	Medium term
	• Provide immediate notification via reports or visual indicators if unexpected cases are received				✓	
	• Develop low inventory alert system by comparing product movement to sales floor or trash compactor case reads with intra-day POS quantities				✓	Short to long term, depending on approach
	• Medium for alerts will vary depending on store system sophistication (for example, simple reports vs. mobile hand-held devices)				✓	
	• Modify store inventory systems to segregate backroom vs. sales floor stock levels to improve ability to locate stock				✓	Medium term
• Modify store perpetual inventory system to accept EPC reads as inventory movements upon receiving in store, movement to sales floor and/or case disposal reads at trash compactor				✓		
	• Define near-term approach and long-term strategy for sharing EPC case reads with manufacturers, 3PLs and distributors (including frequency, medium and relevant read points)		✓	✓	✓	Short to long term

Source: IBM Business Consulting Services analysis.



As outlined earlier, the focus of this paper is pallet- and case-level tagging. It should be noted that some products within health, beauty and cosmetics (HBC) and other product categories are shipped to stores as inner-packs or commingled with products from other suppliers in totes. In addition, some retailers do not move full cases from the backroom to the sales floor, so product-specific handling processes need to be considered when envisioning and estimating future store operations opportunities.

4.2 Distribution Operations

This scenario covers core supply chain activities involving the distribution centers of any participant in the industry value chain, be it a manufacturer, retailer, 3PL, etc. Specifically, it includes:

- Shipment and receipt of products between trading partners (referred to as “goods transfer” below)
- The movement of goods within distribution centers
- Management of logistics assets (referred to as “asset control” below).

4.2.1 Current Issues

Companies throughout the supply chain can use EPC to address today’s distribution process bottlenecks and failures that often result from the complexity of product flow and human error:

- **Complex, labor-intensive receiving processes** – Typically involve actions such as manual barcode scanning and label application; some trading partners utilize EDI ASN/DESADV receipt with SSCC.

- **Errors missed due to “single-scan” receiving** – Retailers often must choose between scanning a single case of each inbound shipment (and accepting errors), or scanning every pallet/case (at high cost in labor and delays). Discrepancies lead to deductions for trading partners.
- **Labor-intensive cycle counting and physical inventory counts.**
- **Frequent human errors in marshalling products for delivery (e.g., wrong unit, wrong lane)** – DCs often engage in manual checking/audits of outbound shipments to reduce likelihood of claims and shipping errors. Despite these efforts, errors still occur.
- **Assets badly organized, unreturned, misused and stolen** – Asset return schemes have largely failed due to the difficulties and costs of tracking them. Assets build up on site, disrupting operations and becoming vulnerable to theft. As a result, required assets are not available when needed, and asset utilization is not optimized (for example, expensive roll cages are used when product warrants only less-expensive dollies).

4.2.2 Process View

Through EPC enablement, distribution operations could become substantially more efficient, orderly and accurate (see Figures 8a and 8b).

- **Efficient and accurate receiving process** – As with store deliveries, any shipments received by a distribution center (e.g., from manufacturer to retailer) would be rapidly and automatically counted into

the DC inventory system via reads of EPC tags on the shipped pallets. A "three-way match" process could check that the goods actually received match the original purchase order and the shipper's electronic shipment notification.

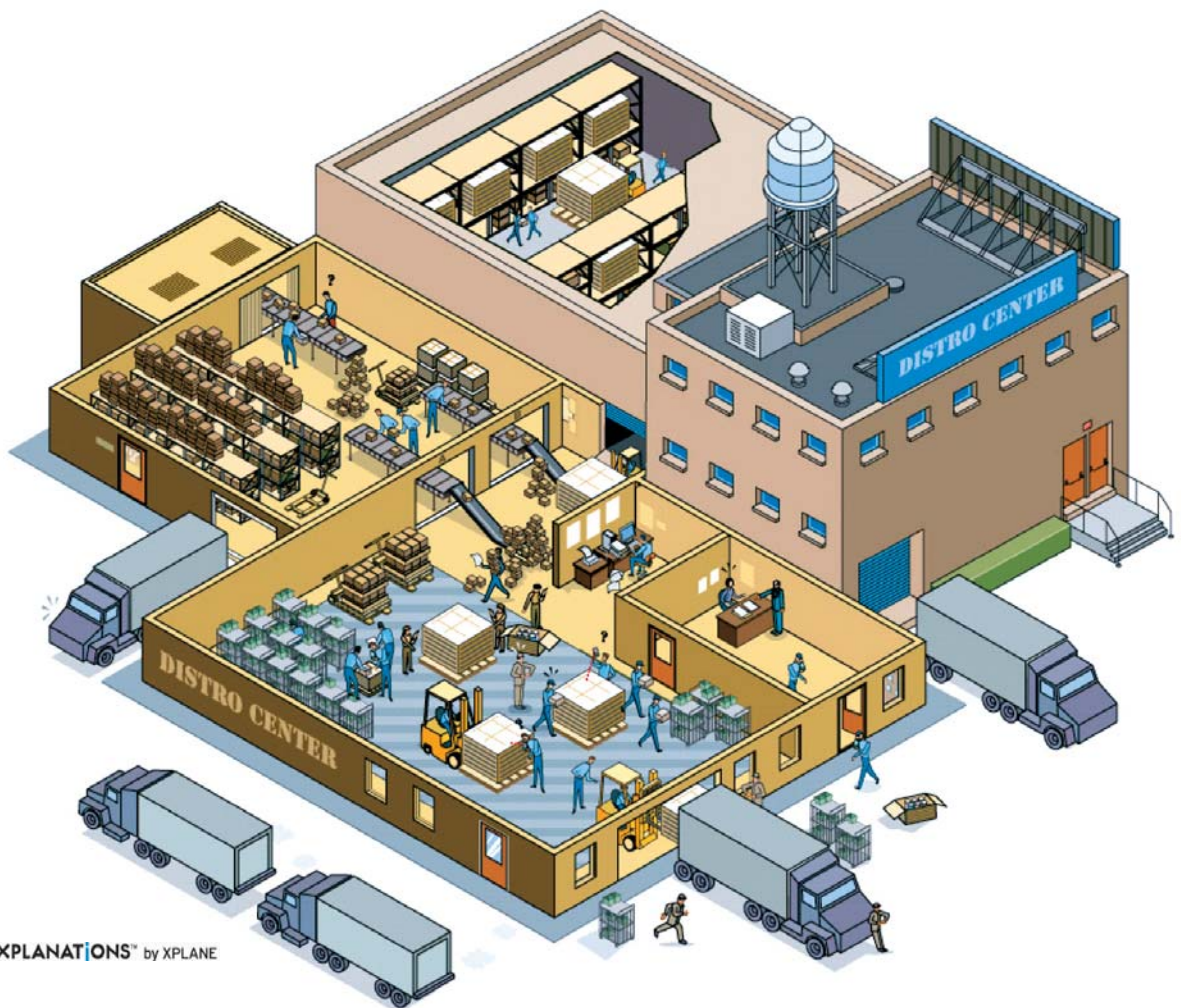
Distribution center personnel have only to visually check the received goods for breaches or damage, or to manually override the check-in process in case of a discrepancy alert. This is of particular importance where mixed pallets are being shipped.

- **Smooth product handling** – Within the distribution center, EPC readers strategically placed around conveyor belt systems could achieve near-100 percent read rates on cases being moved within the DC, regardless of how the cases are placed on the belt (assuming the belts themselves are built from RFID-friendly materials). This would provide significant improvement over today's barcode-based systems, where misreads due to covered or damaged barcodes result in piles of "rejected" products that must be dealt with manually.

Note, however, that the use of conveyor belts is less common in European distribution centers. In this region, goods are typically received, checked and stored on pallets. EPC-enabled forklifts or handheld readers will help companies improve the checking and storage of goods and achieve higher performance compared to today's barcode-based procedures. It will, for example, be possible to identify the location of goods while in transit from the dock doors to the warehouse storage racks.

- **Improved inventory management**
– Through automated, verified stock check-ins and EPC readers strategically placed around the DC (e.g., in doors or on forklifts), the accuracy of location information for cases and pallets would be improved significantly. DC staff could spend far less time in cycle counting and/or conducting physical inventories.
- **Increased cross-docking accuracy**
– Similarly, the use of EPC readers in the cross-docking area would help ensure that the right product is moved to the right place.
- **Efficient and accurate shipping process**
– DC staff could use EPC readers to track cases and pallets as they are picked and packed, enabling "green light" shipping with much less manual compliance checking and processing time. DC staff would thus have greater assurance that the right product was sent to the right door and, ultimately, to the right customer or store.
- **Improved RTI/asset control** – Tags on returnable transport items (RTIs) and other logistics assets (such as pallets, totes, trays, roll cages, etc.) would enable companies to better track their movement and location, providing several benefits. Asset misuse would be reduced and the opportunity for actively managing logistics assets enhanced, helping to ensure that the right assets are available when needed. Asset theft could be prevented more effectively. And companies could better encourage and monitor the return of assets to their proper source.

Figure 8a. Current Distribution Operations Issues.



XPLANATIONS™ by XPLANE

1. Receiving Process:

- Manual scanning of cases or pallets can be labor intensive
- Relabeling damaged or unlabeled product incurs additional labor costs and slows down receiving process

2. Conveyor Reads:

- Misreads lead to segregated product requiring manual attention

3. Inventory Management:

- Inaccurate stock information
- High labor cost of cycle counting and conducting physical inventories

4. Cross-Docking Area:

- Compliance checks contain errors, even if based on barcode scanning

5. Shipment Process:

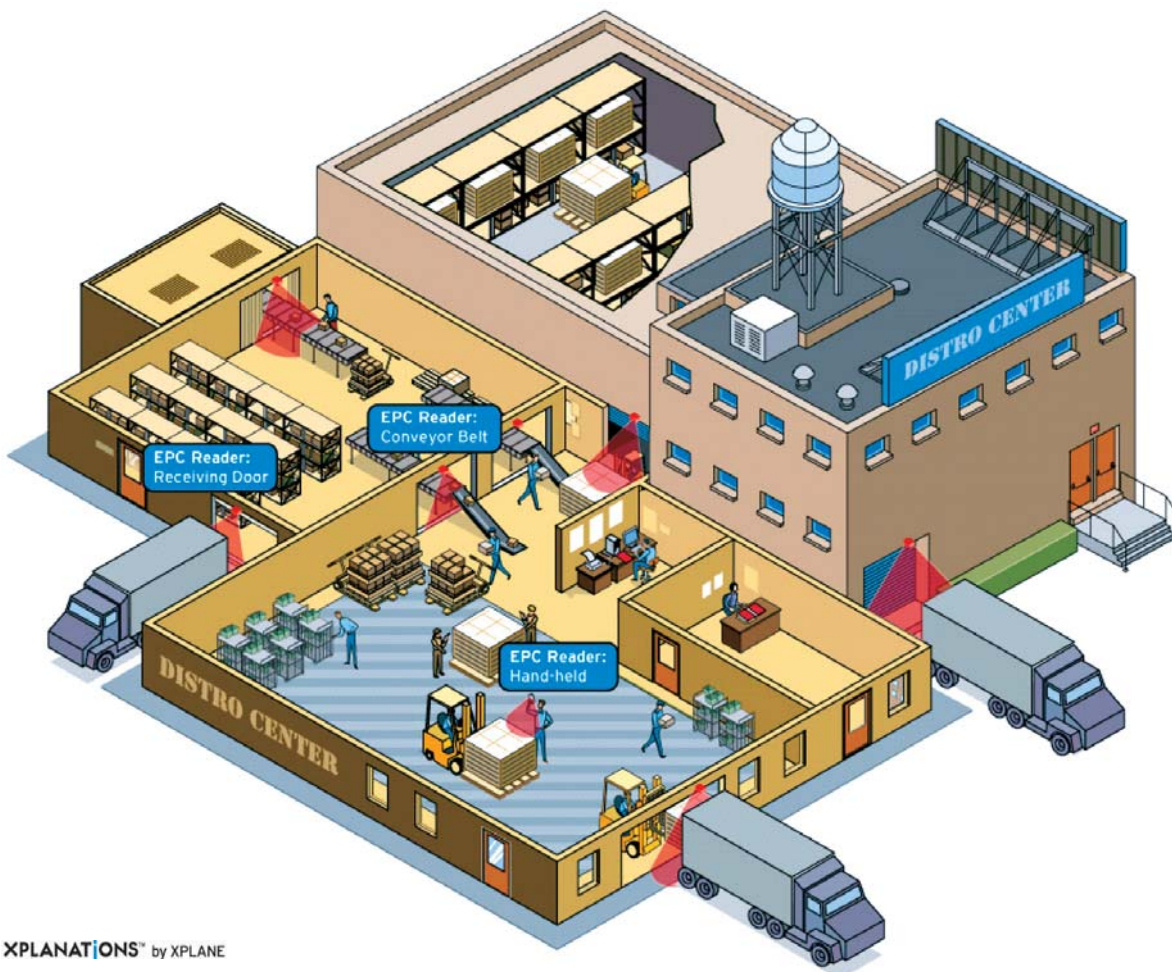
- Wrong products, wrong assets shipped to wrong store
- Or expensive quality control processes required (e.g., audits)

6. RTI/Asset Control:

- Required assets not available when needed
- Poor storage/control leads to theft
- Inefficient returns process

Source: IBM Business Consulting Services analysis; Graphics by XPLANE.

Figure 8b. EPC-Enabled Distribution Operations



XPLANATIONS[™] by XPLANE

1. Receiving Process:

- All pallets identified automatically
- Automatic “three-way match” of products received, PO and shipment notification
- Manual intervention only required for breaches/damages

2. Conveyor Reads:

- Much higher read rates
- Fewer “rejects” that require manual handling

3. Inventory Management:

- Accurate stock information
- Reduced need for manual counting

4. Cross-Docking Area:

- Increased cross-docking accuracy

5. Shipment Process:

- Automated “green light” shipping through pick verification (“pick, pack & ship” match)
- Improved “right product, right door, right store” compliance

6. RTI/Asset Control:

- Improved utilization
- Reduced theft
- Improved returns process

Source: IBM Business Consulting Services analysis; Graphics by XPLANE.

4.2.3 Economic Benefits

As a result of deploying EPC in their distribution centers and goods transfer processes, businesses can obtain the following benefits over time:

- **Significantly improve DC labor productivity** (and therefore lower operating expenses)
- **Reduce the level of claims** and deductions for manufacturers
- **Reduce the amount of time spent on claims resolution** for both retailers and manufacturers
- **Reduce the added capital costs** of "cushion" asset inventory and lost assets.

4.2.4 Implementing the Vision

EPC enablement of the "goods transfer" and "asset control" processes within distribution operations, in particular, will require a variety of business process and system changes that are detailed below.

Goods Transfer

Each party involved in *goods transfer* will need to develop the required capabilities and make certain process changes to implement this EPC-enabled vision at any given step in the supply chain (see Figure 9). For example:

- The supplier's EPC-enabled shipping process must be able to verify the outbound load against the original purchase order and notify the receiving DC with an EPC-linked electronic shipment notification or similar method.

- The receiver's EPC-enabled receiving process then must be able to conduct the three-way match to verify accurate delivery and count the received product automatically into its DC inventory system. Any discrepancies should generate automatic alerts. An electronic proof-of-delivery could also be generated to help the supplier document receipt of the shipped goods.
- To reduce the level of manual intervention required, these communications should be accomplished via "machine-to-machine" data exchange. However, receiving personnel still must have the ability to conduct manual overrides in case of damages.
- Common data interchange and software standards will need to be developed and adopted widely, including by shippers and 3PL companies, to enable trading partners to easily expand and adjust their supply chain relationships over time.

Once some of these foundational capabilities and processes are in place, trading partners could agree to move to a "pay for what was received" operating model based on mutual confidence and trust in the EPC-enabled verification systems, thus eliminating disputes over the goods transfer process. In moving to such a system, trading partners will likely need to conduct pilots that include audits of both shipped and received stock to prove the reliability and accuracy of EPC-based technology. An important consideration is to determine which company (including 3PLs, if involved) would be held liable for any discrepancies that occur.

Achieving full process automation and the full benefits of using EPC in goods transfer or within distribution centers would require near-100 percent tag read rates of palletized product. Based on that requirement and current technology limitations (products containing metals, liquids or metalized films may cause physical problems in tag reading), companies may need to prioritize EPC deployment in non-palletized or EPC-friendly product categories, and conveyor-focused environments. Product categories with inadequate read rates would need to be handled differently.

Note that companies will probably not capture significant benefits until significant scale is achieved for EPC enablement across their DCs, which may take some time.

Asset Control

With regard to *asset control*, the key process change is to provide incentives for site managers to be measured on asset-returns compliance, driven by the EPC-generated visibility of asset movements and location (see Figure 10). Some companies may wish to deploy a new asset management application to systematically monitor compliance with desired business rules. This system could also interface with transport and warehouse management applications to optimize asset availability against logistics requirements (i.e., right mix of assets available in the right place at the right time).

It should be noted that tagging a company's entire estate of assets will present a considerable logistical challenge. A "rolling" or

Figure 9. Distribution operations/Goods transfer: Key implementation requirements.

	Description	Responsible Party				Timescale
		Raw Mat'ls Supplier	CP Mfr.	3PL	Retailer	
People/ Process	<ul style="list-style-type: none"> Shipper's EPC process automatically verifies outbound load against order ("Pick, Pack, Ship" process) and notifies customer's EPC system of delivery information (via EPC electronic shipment notification or other method) Receiver's process counts the delivery in automatically (via EPC three-way match) 	✓	✓	✓	✓	Short term
	<ul style="list-style-type: none"> Receiving process simplified to making visual checks and manual overrides for breaches and discrepancies 	✓	✓	✓	✓	Short term
	<ul style="list-style-type: none"> Advanced implementation: Move to a "pay for what was received" model, with no disputes 	✓	✓	✓	✓	Medium term
System	<ul style="list-style-type: none"> Machine-to-machine EPC data exchange required (trading partner to trading partner) to provide incoming EPC shipment information Methods may include EPC/IS, EPC information within electronic shipment notification, EDI, etc. 	✓	✓	✓	✓	Short term*

*Goods Transfer system changes are expected to take place in the short term for early adopters (e.g., top trading partners); may take longer for others.

Source: IBM Business Consulting Services analysis.

Figure 10. Distribution operations/Asset control: Key implementation requirements.

	Description	Responsible Party				Timescale
		Raw Mat'ls Supplier	CP Mfr.	3PL	Retailer	
People	<ul style="list-style-type: none"> Site managers (DC and store) have asset management added to performance metrics 	✓	✓	✓	✓	Short term or Medium term, depending on level of priority
Process	<ul style="list-style-type: none"> New asset management process to be implemented, driven by EPC visibility data 	✓	✓	✓	✓	
System	<ul style="list-style-type: none"> New asset management application incorporating new business rules (e.g., roll cages must be returned by all stores within 48 hours) 	✓	✓	✓	✓	

Source: IBM Business Consulting Services analysis.

phased tagging program is the most likely solution, one that will require time and careful planning. The tagging effort would also need to be integrated with any asset renewal programs underway.

4.3 Direct Store Delivery

This scenario addresses some of the supply chain execution issues and opportunities *specific to* DSD-based supply networks (note that collaborative opportunity areas such as promotion/event execution, total inventory management, asset control, and track and trace may also be applicable to DSD as well).

4.3.1 Current Issues

EPC enablement can help DSD suppliers and their retail customers address current issues such as:

- **Delivery errors** – Similar to retailer DCs, the DSD model requires distributors to

pick products at their supply depots for a wide range of customer locations and to deliver the right products to the right stores on "multi-drop" delivery routes. The inherent complexity of this activity often leads to delivery errors.

- **Check-in wait and turnaround times** – Today, most retail customers require DSD suppliers to replenish product during normal store delivery windows so retail staff can monitor deliveries and verify product receipt. As retailers continue to drive efficiencies by reducing delivery windows, often the receiving process involves lengthy wait times caused by multiple deliveries arriving at the same time. These include the retailer's own delivery vehicles arriving from their own distribution centers.
- **Out-of-stocks and lost sales** – The inefficiencies in the DSD supply chain described previously can lead to

missed or rushed delivery stops, lower performance on shelf replenishment and merchandise presentation, and, ultimately, out-of-stocks and lost revenue.

- **Invoice discrepancies** – Delivery errors help fuel inconsistencies in delivery receipts and invoices and the need to reconcile financial records between retailers and DSD suppliers.

4.3.2 Process View

As in traditional DC operations, EPC can drive improved efficiency and accuracy in shipping and receiving activities and asset control. It can also reduce back-office transaction discrepancies (i.e., invoice discrepancies). And with cooperation from retail customers, DSD suppliers could achieve store-level benefits in terms of on-shelf availability and labor productivity (see Figures 11a and 11b).

- **Improved warehouse management** – There is the potential for DSD distributors to improve warehouse operations through the use of EPC/RFID in the areas of fleet management and pick-and-pack activities. The level of improvement will depend on the current degree of automation in the warehouse. Note that because most DSD distributors have a large number of supply depots, the cost of EPC enablement may be much greater than that of a warehouse manufacturer or retailer.
- **Efficient store deliveries** – In an EPC-enabled model, readers at the store backroom would automatically capture

the movement of DSD products into the store and enable migration to a more automated check-in and delivery process. This change can reduce the wait times caused by manual check-in and may offer the opportunity for off-hour deliveries.

- **Improved store-level service** – This delivery scenario provides quicker turnaround times to DSD personnel, helping to reduce the incidence of missed or rushed drops at the end of the day. In addition, they can spend more time at each drop reviewing merchandise presentation, product quantities and promotion execution. Replenishment and service to the store and end consumers would improve.

4.3.3 Economic Benefits

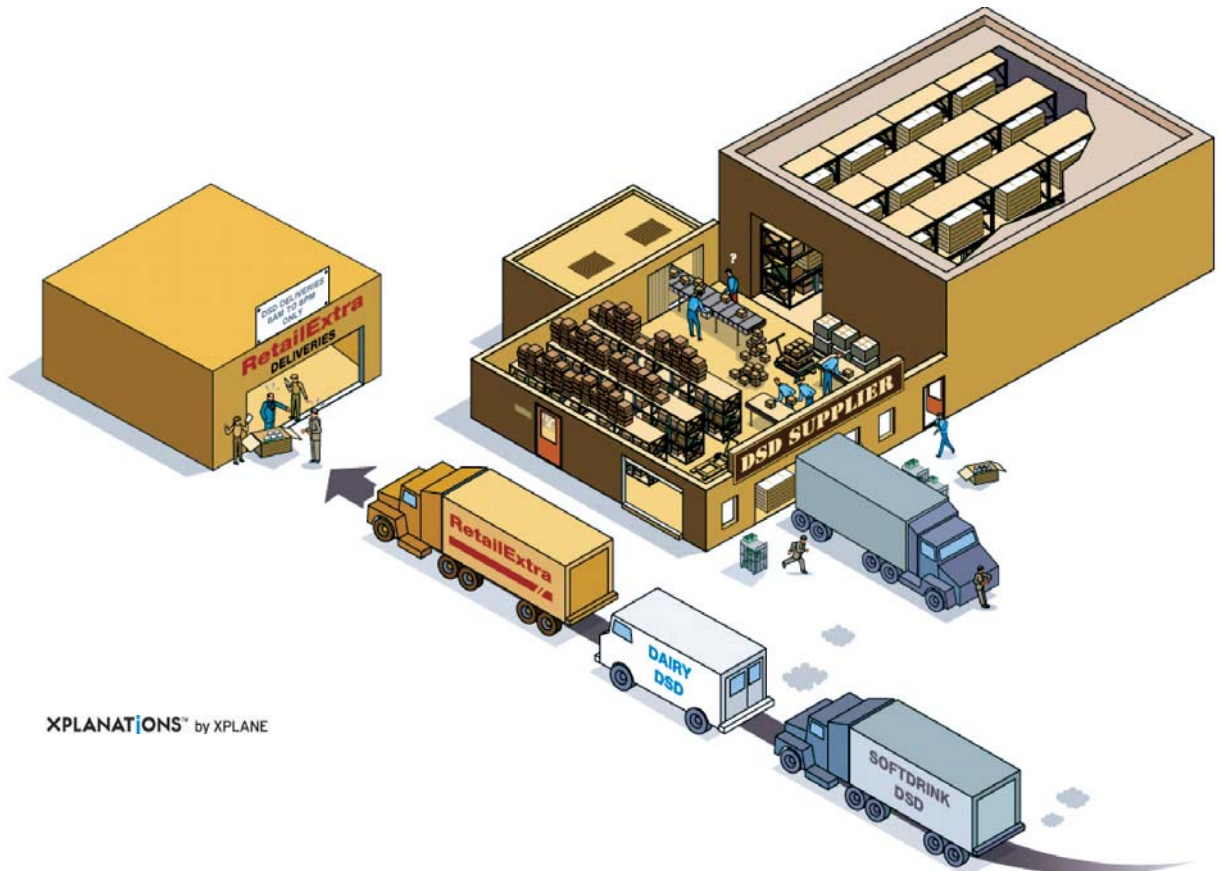
DSD manufacturers can realize **improved on-shelf availability and sales, higher labor and asset productivity, and reduced invoice discrepancies.**

Retail customers can benefit from **reduced out-of-stocks and reduced labor requirements** in the receiving process.

4.3.4 Implementing the Vision

As indicated previously, this vision of an EPC-enabled DSD supply chain requires both the supplier and the retailer to make changes in their existing business processes and policies (see Figure 12). The supplier will need to implement the systems and processes required to improve warehouse management. Shipment information will need to be transmitted to retail customers

Figure 11a. Current Direct Store Delivery Issues.



XPLANATIONS™ by XPLANE

1. Supplier Depot:

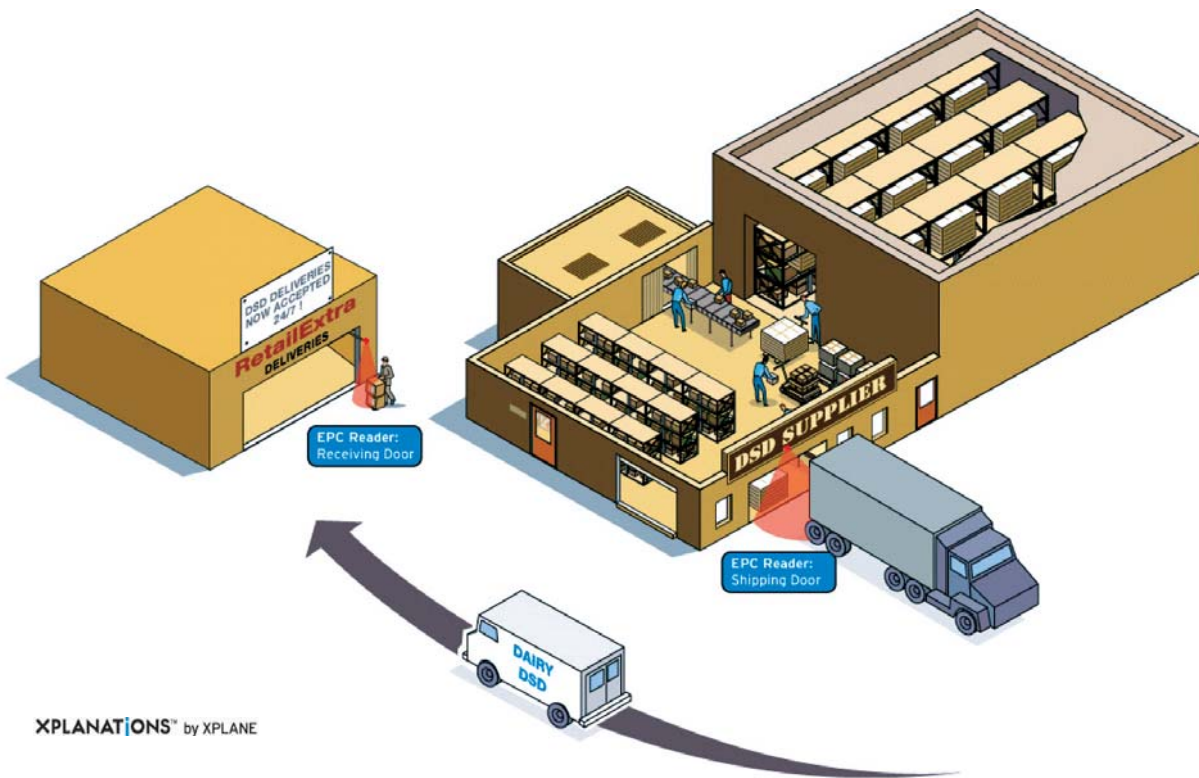
- Performing store picks for wide range of customers
- High labor requirement to check shipment accuracy
- Multi-drops and volume of shipments result in errors

2. Store Delivery:

- Retailers require “in hours” deliveries so store employees can manually check delivery accuracy
- Delivery windows narrowing and retailer’s own vehicles prioritized over DSD suppliers, thus delaying turnaround times

Source: IBM Business Consulting Services analysis; Graphics by XPLANE.

Figure 11b. EPC-Enabled Direct Store Delivery.



1. Supplier Depot:

- Improved warehouse management
- Improved product track and trace

2. Store Delivery:

- Potential for "off hours" check-in and delivery
- Automatic match of products received and shipment notification
- Improved turnaround times and fleet utilization for DSD suppliers

Source: IBM Business Consulting Services analysis; Graphics by XPLANE.

to verify accurate receipt of goods at the store. As with the DC-based Distribution Operations scenario, electronic proof-of-delivery could be sent back to the supplier to document the transaction and approve payment. Full implementation of this vision would include automatic initiation of payment transactions based on these EPC-verified deliveries between retailers and their suppliers.

To enable an automated check-in and delivery model that optimizes route efficiency for DSD suppliers, retailers may need to modify their store security and receiving policies to accommodate off-hour, potentially 24x7, deliveries into a secure, EPC reader-controlled area of the store backroom. In such a scenario, retailers will also need to create in-store access for merchandising activities. In addition,

DSD access to temperature-controlled (e.g., chilled/frozen) areas may need to be addressed through specific procedures.

In some trading relationships, DSD suppliers are being asked to deliver products not in cases, but in individual consumer units or on trays. Case-level tagging would not be relevant, and tags would need to be applied to the trays or items themselves. In the longer term, item-level tagging could generate additional savings in DSD categories. Supplier merchandising personnel could use hand-held readers to determine on-shelf inventory levels more quickly and link this information to automated reorder mechanisms. The result could be more accurate and efficient replenishment to further address out-of-stock situations. (At the same time, however, this scenario would require companies to invest in new EPC-capable mobile devices.)

Figure 12. Direct Store Delivery: Key implementation requirements.

	Description	Responsible Party				Timescale
		Raw Mat'ls Supplier	CP Mfr.	DSD Dist.	Retailer	
People/ Process	• DSD supplier to implement automated EPC-based warehouse efficiencies			✓		Short term
	• Retailer's store labor model changes to reflect automated check-in and delivery model				✓	
	• Store security policies revised to handle off-hours DSD				✓	
	• Implement data synchronization between supplier and retailer to ensure all items and prices are synchronized in the retailers' store systems		✓	✓	✓	
	• Retailer to implement automated validation of DSD receipt and initiate back-office transactions for payment		✓	✓	✓	
	• Ensure appropriate security measures are implemented to enable automated check-in and delivery			✓	✓	
System	• Conduct automated three-way match (goods ordered vs. goods shipped [EPC ASN/DESADV] vs. actual goods received)		✓	✓	✓	Medium term
	• Supplier EPC infrastructure to interface with EPC-driven warehouse applications and enterprise systems that support back-office transactions		✓	✓	✓	Short term
	• Retailer receiving systems to use EPC reads as proof of receipt and automatically update inventory levels and supplier-specific payment systems		✓	✓	✓	
	• Suppliers and retailers should implement EPC information-sharing solutions leveraging the EPC network and standard measures for success		✓	✓	✓	

Source: IBM Business Consulting Services analysis.

The next set of transformational scenarios focuses on areas that involve collaborative exploitation of EPC-generated information to improve the management of key cross-companies processes and address some of the more challenging problems facing manufacturers and retailers today.

4.4 Promotion/Event Execution

This scenario addresses some of the issues and opportunities specific to the execution of promotions, events and new product introductions, encompassing activities from the manufacturer distribution center to the retail sales floor.

4.4.1 Current Issues

EPC can help trading partners address the issues that arise from lack of visibility into store-level promotion execution:

- Delayed compliance or non-compliance by stores
- Diversion of promoted products to the wrong stores
- Poor coordination with advertising programs, leading to out-of-stocks, lost sales, reduced consumer satisfaction, and excess markdowns or returns.

4.4.2 Process View

To help resolve these issues, trading partners can build upon the EPC-enabled capabilities outlined in Store Operations specifically to enhance communication and collaboration among trading partners related to promotional and new product introduction activities (see Figures 13a and 13b).

- **Improved store-level visibility** – With EPC readers located at store receiving and sales floor entry doors, real-time data would be available to help companies verify that on-promotion product and promotional materials (e.g., displays) are delivered to the store and moved onto the sales floor to coincide with specific promotional activities.

- **Actionable, more efficient compliance monitoring** – As this information is shared by retailers with their suppliers, manufacturer personnel would have greater visibility into promotion compliance at the store and may be able to reduce the number of store visits they have to make to address non-compliance issues. In addition, trading partners could proactively work together to coordinate the staging and movement of products with planned advertising and other events, improving the effectiveness of promotions in the marketplace.

4.4.3 Economic Benefits

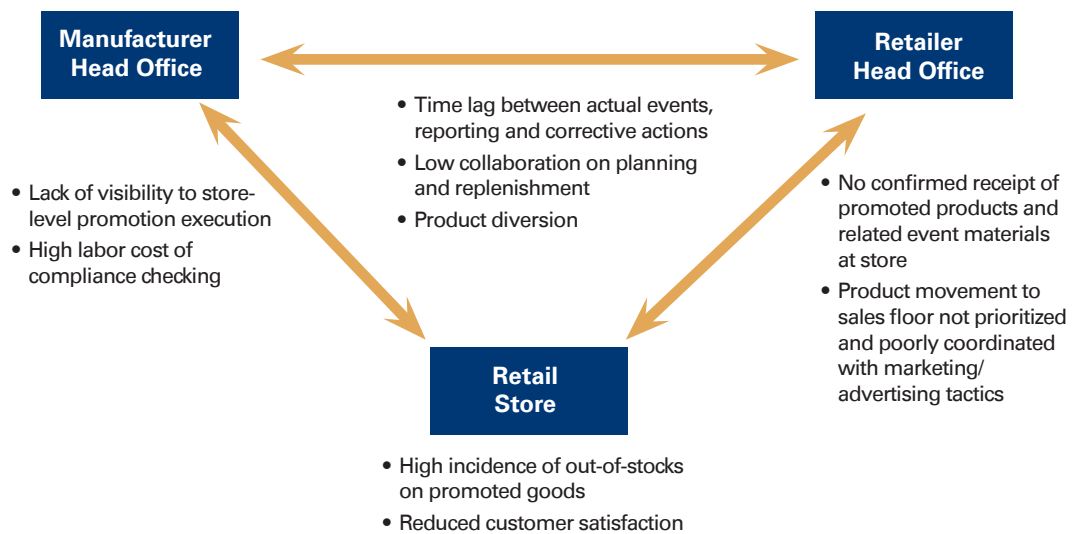
These changes, when coupled with EPC-enabled replenishment processes, can help drive **improved on-shelf availability for promoted products and, therefore, higher consumer satisfaction and sales** for both trading partners.

Manufacturers can better monitor the effectiveness of their promotional spend, **reduce wasted investment and decrease labor costs** related to compliance management. In the future, the information provided by EPC could also be used in promotion planning and trade funds allocation discussions to better optimize spending in these areas.

4.4.4 Implementing the Vision

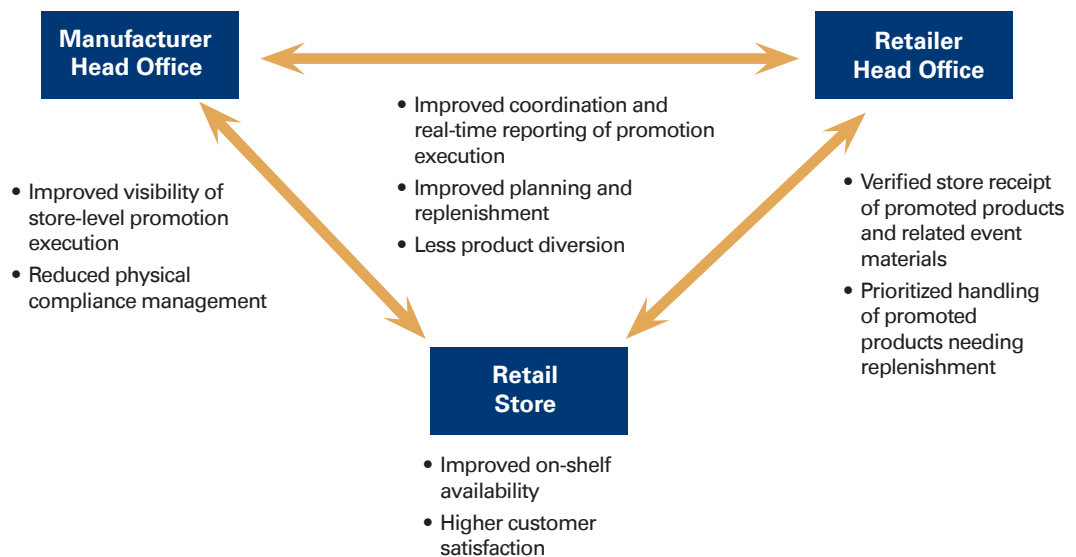
To make this scenario possible, retailers and manufacturers would have to build collaborative relationships supporting the management and execution of promotions, sharing data on product movement and promotion compliance at individual stores (see Figure 14). To enable real-time communication of this data, trading partners would either need to implement a custom-designed, standards-compliant supplier information portal or use the EPCglobal Network infrastructure. In either case, scale and efficiency are more likely to be achieved through an EPC-enabled industry standards-based solution.

Figure 13a. Promotion/event execution: Today's issues.



Source: IBM Business Consulting Services analysis.

Figure 13b. Promotion/event execution: EPC enablement.



Source: IBM Business Consulting Services analysis.

Future requirements may include the ability to agree and document desired promotional quantities by trading partner, store and date – and the use of alerts or "management-by-exception practices" to alert both retailers and manufacturers when desired movements do not occur. These capabilities could be particularly useful in monitoring new product introductions, given the high level of focus and expense incurred in this area.

Furthermore, manufacturers and retailers may need to modify existing systems to make use of the serialized EPC number to identify on-promotion products differently than normal stock. This capability would enable automatic identification and prioritized movement of promoted products before they are unpacked. Store-level systems would need to be modified to make use of the serialized case codes to identify specific on-pack promotions.

4.5 Total Inventory Management

This scenario outlines how trading partners can exploit the broader, more granular, real-time stock visibility afforded by EPC to reduce overall inventory levels across the supply chain.

4.5.1 Current Issues

EPC-enabled systems and processes can be harnessed to address one of the major issues that continue to plague industry supply chains: the ripple effect of **excess inventory and safety stocks** that manufacturers and upstream suppliers must maintain as a result of:

- **Poor downstream inventory visibility** – Manufacturers, for example, have little visibility of product flow through the retailer’s supply chain. Unable to precisely monitor demand levels and forecast when new orders will be placed,

Figure 14. Promotion/event execution: Key implementation requirements.

	Description	Responsible Party				Timescale
		Raw Mat’ls Supplier	CP Mfr.	3PL	Retailer	
People/ Process	• Install reader systems in store backrooms and at the door to the sales floor to help validate movement of promoted or new products				✓	Short term
	• Provide visibility to store employees and suppliers to enable monitoring of specific events or products		✓	✓	✓	
	• Manufacturers reduce frequency of physical store visits to check event compliance		✓		✓	Medium term
System	• Jointly agree upon and define promotional or event inventory staging plans					Medium term
	• Use these systematic agreements as triggers to generate alerts or reports when agreed-upon product movements do not occur		✓	✓	✓	
	• Retailers to provide more accurate promotional product mix/location data to suppliers to jointly manage events		✓	✓	✓	

Source: IBM Business Consulting Services analysis.

they need to build up safety stocks to maintain service levels. Retailers themselves have less-than-optimal visibility into store-level inventory and demand fluctuations.

- **Disconnected forecasting and planning activities** - Demand planning throughout the value chain is largely based on historical sales patterns, rather than active, "real-time" monitoring. Planning accuracy for manufacturers is dependent on the frequency of retailer orders and manufacturers' ability to use retail POS data, which can be problematic in terms of accessibility, reliability and ease of integration with forecasting systems. Time lags between orders and updates also help to drive up safety stock requirements.
- **"Corrupted" store demand signals** – When store employees "zero out" inventory in the store book stock system, it can lead to the placement of premature or unnecessary replenishment orders, thus causing a build up of excess inventory at that store.

4.5.2 Process View

The EPC-based capabilities detailed in the Store Operations and Distribution Operations scenarios provide the foundation for improved supply chain collaboration on total inventory management (see Figures 15a and 15b).

- **Improved store demand signal** – As EPC is rolled out in stores to enhance store and shelf replenishment, one of the second-order effects of increased stock information accuracy would be improvement in the demand signal. Store employees should no longer be allowed to incorrectly "zero out" inventory in the store book stock system simply because they cannot find the product. The

replenishment orders placed would thus reflect more accurately the true level of inventory and demand at the store.

- **Improved planning and forecasting** – By sharing EPC case and pallet movement data with their suppliers, retailers would allow manufacturers to use this information to improve their planning and forecasting activities. Manufacturers would receive more granular and more frequent updates about inventory levels in the downstream supply chain, allowing them to more regularly compare actual product movements with their forecasts and to update them accordingly. Short-term planning and execution would be done in line with actual store activity and shipments, not historical sales forecast information.
- **Reduced safety stocks across the total supply chain** – With this improved visibility and confidence in the stock information at their stores, retailers could reduce the levels of safety stock held at their distribution centers. For their part, as manufacturers build greater confidence in the accuracy and consistency of downstream demand signals, they could implement more dynamic replenishment processes and potentially change their inventory policies to reduce the safety stocks held at their own distribution centers.
- **Upstream supply chain benefits** – If manufacturers, in turn, shared their forecasts and production plans with their own suppliers, these inventory reduction benefits could similarly be shared with raw materials and packaging suppliers.

In the long run, some companies view EPC as an enabler to help transform the purchase order process as we know it today. As suppliers gain more visibility to store-level inventory and product movement data, they could take a more active role

in managing their product inventories at the store. Suppliers could, for instance, use EPC demand signals to execute their own replenishment plans. If this process was linked with financial transactions, EPC reads could automatically trigger replenishments, transfer of ownership and underlying financial transactions between trading partners. More timely payments could offset the additional costs of managing inventory at a store level.

4.5.3 Economic Benefits

Upstream suppliers, manufacturers and retailers that are able to collaborate with their trading partners in these ways will likely be able to **free up valuable capital currently tied up in excess inventory**.

4.5.4 Implementing the Vision

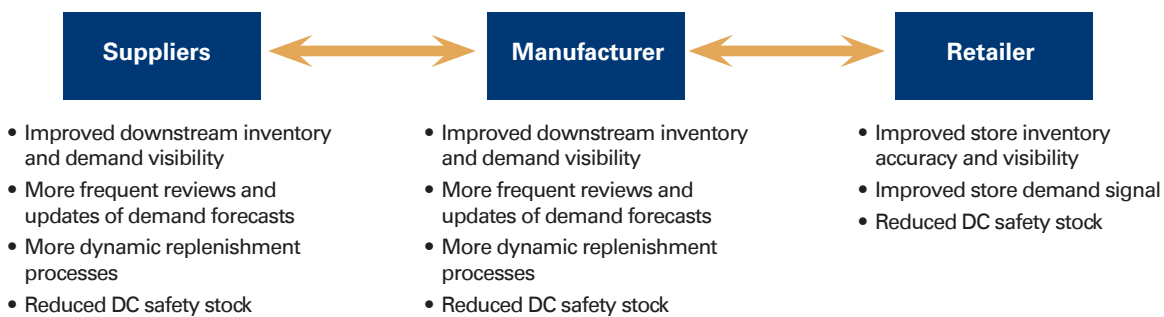
To achieve the outcomes described in this scenario, retailers, manufacturers and other key supply chain partners will need to actively communicate EPC product

Figure 15a. Total inventory management: Today's issues.



Source: IBM Business Consulting Services analysis.

Figure 15b. Total inventory management: EPC enablement.



Source: IBM Business Consulting Services analysis.

movement information and collaborate better than ever on demand forecasting and planning (see Figure 16). In particular:

- A key skill that companies will need to implement the vision (and one that they can start building now) is “time mapping”, or recognizing where the time and inventory requirements exist in their supply chains today. This exercise will identify near-term opportunities to deliver benefits quickly, but it does require some skill and experience.
- Trading partners need some system for sharing more granular and frequently updated information about product movement and demand and inventory conditions, such as an EPC information system.
- Planning, forecasting and replenishment processes and systems need to be adapted to take advantage of this information. Manufacturers will need to aggregate relevant data across stores and customers. Replenishment algorithms may need to be modified or to become “self-adaptive” to optimize stock levels. During the transition, manufacturers will need to determine how to use this “fractional demand” data for a subset

of SKUs from a subset of EPC-enabled customers to drive changes in customer-specific replenishment policies and processes.

- Fundamentally, suppliers will have to build trust and confidence in the accuracy of the inventory information and the demand signal to reduce safety stocks by any significant level. In fact, some manufacturers conversely assume *increased* safety stock requirements as retailers lower their own inventory levels.
- Some also believe that manufacturers will only be able to reduce inventory levels after there is broad EPC adoption among retailers, which may take some time to achieve.

In the long term, manufacturers may investigate additional ways of changing their production planning and execution strategies to be more demand or “pull” oriented. This could involve moving from forecast-driven, weekly or monthly manufacturing plans to more frequent production runs that are aligned with new EPC-driven replenishment processes. While such shifts may require fundamental changes to manufacturing operations, they could result in significantly lower inventory levels.

Figure 16. Total inventory management: Key implementation requirements.

	Description	Responsible Party				Timescale
		Raw Mat’ls Supplier	CP Mfr.	3PL	Retailer	
People/ Process	• Identify time delays and excess inventory in current supply chain (“time mapping”)		✓		✓	Short term
	• Realign/retrain staff to do EPC-based planning, forecasting and replenishment activities more effectively and on an exception basis	✓	✓	✓	✓	Medium term
	• Reengineer safety stock algorithms to account for EPC event data – what mix is located where and in what volumes	✓	✓	✓	✓	Medium term
System	• Drive planning, forecasting and replenishment application development off of retailer-provided EPC movement data	✓	✓	✓	✓	Medium term

Source: IBM Business Consulting Services analysis.

It should be noted that no matter how transparent the supply chain becomes, unforeseen events will still occur and companies will always need to hold some level of safety stock. That said, EPC could be leveraged as described in this scenario to achieve substantive improvement in the industry's current level of performance.

4.6 Shrink Management

Companies across the industry supply chain could take advantage of EPC-based product movement data to better identify and control shrink. As with the preceding scenarios, this vision is built upon the EPC capabilities outlined in Store Operations and Distribution Operations, as well as DSD for those types of supply networks.

4.6.1 Current Issues

The sources and causes of shrink have been extensively studied in various industry studies (see Appendix B for a listing of key references), but, in general, they can be classified into four categories:¹⁰

- **External theft** – e.g., from store thieves, grazing and returns fraud
- **Internal theft** – e.g., theft by employees, contractors and collusion (at POS and receiving)
- **Process failures** – e.g., incorrect deliveries, counting or pricing; out-of-date or damaged goods; markdowns
- **Inter-company fraud** – e.g., willful misshipments or pricing discrepancies.

Companies across the supply chain are vulnerable to these forms of shrink largely due to poorly managed processes or controls. Some of the issues that inhibit more active and effective management of shrink include the following:

- **Lack of visibility into key links in the supply chain**, such as transportation between distribution centers and stores, where theft often occurs
- **Lack of timely information about when and where shrink occurs**, making it more difficult to trace after the fact; All tracking is reactive with a significant dependence on employee accuracy and honesty
- **Insufficient security deterrents** for own or trading partner employees.

4.6.2 Process View

The potential role of EPC in shrink management is straightforward. Improved shrink management would be achieved by comparing the actual EPC tag movements being captured by readers installed at receiving/shipping doors and other key locations with the movements that are planned or expected. Any discrepancies could be automatically logged, highlighted or sent to relevant managers for their prompt attention.

4.6.3 Economic Benefits

By exploiting EPC's capabilities as outlined in this section, companies can **reduce the magnitude and impact of shrink, improving their bottom line.**

4.6.4 Implementing the Vision

This scenario could be implemented at a manufacturing site, a finished goods warehouse, a retail distribution center or a store. To bring it completely to fruition, trading partners must have certain systems and information-sharing processes in place (see Figure 17):

- Interfaces between EPC systems and the relevant site inventory management system (e.g., warehouse management system [WMS] in the distribution center) to capture data on what, when and where products are being moved.
- Cooperative sharing of EPC movement data among trading partners (including logistics providers) to close “blind spots” in the supply chain and compare planned versus actual product movements.

- EPC readers placed at key points of egress (e.g., employee exit door) to help serve as a deterrent to malicious threats.
- An “alerts” system and new asset protection and loss prevention techniques to take advantage of more timely warnings and increase the speed of response.

It should be noted that EPC is not the only tool available to companies to handle shrinkage. Other complementary tools and methods exist, such as those highlighted by recent ECR Europe studies. In developing future shrink management strategies, companies should also consider that EPC tracking could eventually be incorporated into or replace today’s electronic article surveillance (EAS) systems.

Figure 17. Shrink management: Key implementation requirements.

Description		Raw Mat’ls Supplier	CP Mfr.	3PL	Retailer	Timescale	
People/ Process	• Changes to asset protection/loss prevention activities in stores and DCs to adapt to EPC-event data	✓	✓	✓	✓	Short term	
	• Adjustments to existing loss prevention processes to respond to unauthorized EPC events/alerts	✓	✓	✓	✓	Short term	
System	• Interface between WMS and EPC event system	✓	✓	✓	✓	Short term	

Source: IBM Business Consulting Services analysis.

5. Industry Action Plan

Based on the findings and conclusions presented in this report, GCI has developed recommended actions for individual companies, trading partners and the industry as a whole. Taking these steps will enable us to build on today's achievements and deepen our collective knowledge on how best to approach EPC implementation across the industry.

5.1 Actions for Individual Companies

1. Understand and communicate the EPC vision within your own organization.

- **Identify an executive sponsor** from the supply chain, purchasing or logistics areas who actively supports the EPC vision and champions the potential benefits for your company. **Obtain the necessary sponsorship and resources** from this person to conduct a well-defined, limited pilot.
- **Set up a full, cross-functional team**, since the introduction of EPC technology will affect operations, purchasing, finance, supply chain, IT, sales and marketing. All of these functions need to be aware of the potential impact on work processes and the business as a whole. They should be part of the team that determines how your company can best exploit this technology.
- **Incorporate an EPC vision into your information management strategies** with customers and suppliers so that, together, you can begin to develop a roadmap for how EPC/RFID capability will be used to improve trading relationships.

2. Learn by doing.

There is no substitute for gaining direct experience working with EPC to develop deeper insight on the magnitude and source of potential benefits and determine the best approach to implement. In particular:

- **Do your own business case analysis**, if your company has not done so yet, specific to your own product categories, supply chain conditions and trading partners (see Appendix A for more details).
 - Identify issues and opportunities within your organization that can be addressed with EPC technology.
 - To produce a robust estimate of likely costs, make a comprehensive assessment of specific tag costs, infrastructures, product category characteristics and process changes.
 - Perform detailed analysis of the benefit areas highlighted in this report that are pertinent to your business.
 - Use your own business case analysis as the best source of direction for where the biggest opportunities lie and where pilot work should be focused.
- **Experiment with and investigate the use of EPC** to understand how EPC technology will interact with your products.
 - Leverage the experience and learnings that already exist in the industry. The starting point for any pilot should be to build on the knowledge available through the

EPCglobal Pilot and Implementation Work Group. This approach can also reduce the cost of subsequent testing.

- Assess the RFID “friendliness” of your products by using laboratory situations to tag and test cases and pallets of all your products.
- Conduct pilots in distribution, manufacturing and store operations to assess the impact of EPC technology, where it works and where it does not.

3. Ensure your company has clean, accurate, timely and standards-based data that is aligned and shared with trading partners.

- Product data should be shared electronically in an automated fashion.
- Global Data Synchronization (GDS) is the recognized best practice for the industry.
- Data requirements will expand beyond product and price to include location, asset and movement data.

4. Participate in and support EPCglobal groups and standards.

Adherence to the standards set by such industry groups (including GS1 and the International Organization for Standardization [ISO] as well) is essential. Companies need to know that they can invest with confidence in tags, readers, infrastructure and data sharing technologies. Globally accepted standards are critical to driving worldwide adoption, speeding time to critical mass and driving the cost reductions required to make business cases feasible across more areas of the industry. Your company should consider participating at local, regional and global levels in one or more of the following groups:

- Local EPCglobal/GS1 working groups dealing with EPC adoption
- Regional action groups, such as the European Adoption Programme, to share your initial learnings and experiences with local market requirements

Forging Universal EPC Standards: EPCglobal

The success of product numbering, barcoding and EDI was mainly due to the work of GS1 (formerly known as EAN International) and the Uniform Code Council, which together comprised over one hundred countries working together to develop a common set of standards. The industry will now be looking to EPCglobal to do the same for EPC.

EPCglobal was created in 2003 to commercialize the business solution that was developed by the Auto-ID Lab. As a not-for-profit joint venture between GS1 and GS1 US (the latter formerly known as The Uniform Code Council), it serves as the standards-making body entrusted by industry to lead the worldwide commercialization and standardization of EPC technologies through the EPCglobal Network.

The EPC technologies cover the standard way in which data is encoded on a tag and subsequently read by readers and passed on to the EPCglobal Network. The latter is based on the use of standard keys (e.g., serialized GTIN), standard data messages and content with standard technical interfaces. Put together in a secure network, they allow for data to be moved, stored and retrieved by all members of the network.

For further information, please visit the EPCglobal web site: <http://www.epcglobalinc.org>.

- Industry segment-specific action groups, such as those for Fast-Moving Consumer Goods and Healthcare Life Sciences
- Global EPCglobal working groups, as appropriate, to participate in and influence the standards-setting process.

5. Understand and address the consumer and public policy perspectives on EPC.

Proactively work to address consumer privacy concerns and foster accurate understanding of EPC’s capabilities, role in the supply chain and end-consumer benefits. Participate in and support those public policy groups that focus on addressing consumer and policy maker interests in EPC, such as the EPCglobal Public Policy Steering Committee. Legislative agendas to be addressed include environmental, health, safety and privacy concerns.

5.2 Actions for Improved Trading Partner Collaboration

6. Embrace the exchange of supply chain information and collaboration, via the EPCglobal Network, as a source of business improvement, not as a threat.

The EPC vision for improved execution and cooperation around areas such as on-shelf availability, inventory levels and shrink is fundamentally based on open sharing of data captured by the EPCglobal Network. Companies therefore should:

- Establish clear working practices with trading partners based on the availability of free, standards-based information as a prerequisite for pilots and roll-out of EPC technology.
- Ensure that their data is systematically updated and shared with trading partners. GCI endorses that this

be done via the Global Data Synchronization Network (GDSN). The ability to maintain accurate product data will foster better use of EPC capabilities.

7. Engage in meaningful pilots with trading partners.

More companies need to get involved in EPC pilots to deepen understanding of the opportunities and challenges associated with EPC implementation in a broader range of product categories, markets and supply chain environments.

- Base pilot plans on the business opportunities identified in mutual business cases, setting clear parameters and metrics so that goals and achievements can be transparently shared.
- Move beyond a focus on “tagging” to address business process transformation with the goal of proving potential benefits. Companies cannot achieve EPC’s full benefits by working alone. As shown by the barcode experience, lack of change in business practices will delay the realization of benefits for consumers and the industry as a whole. Companies that actively work with trading partners to improve overall supply chain performance are more likely to succeed in the marketplace.

8. Leading adopters should share their knowledge, experience and findings more widely.

Greater awareness and understanding across the industry will help encourage further pilots and implementation. Importantly, the results should be shared widely to help the industry address common issues and demonstrate the business benefits achieved through the use of EPC technology.

- Companies should begin reporting EPC results in terms of the business value obtained (such as reduction in out-of-stocks), rather than technical results (such as number of tagged units or read rates).
 - Companies should participate in public industry forums and open workgroups dedicated to the sharing of knowledge among manufacturers and retailers in order to improve the value derived from EPC in the industry. Leveraging existing learnings and contributing to the base of information available will help speed implementation and navigate common roadblocks.
 - EPCglobal should consider establishing a reference database with links to all publications dealing with EPC/RFID, to provide industry executives with an easy way to get an overview of relevant information and literature.
- 9. Manufacturers and retailers should collaborate to craft a workable roadmap for EPC deployment for both trading partners.**
- A shared industry focus is needed to drive EPC adoption in higher-potential product categories first. In this way, the industry can build economies of scale, accelerate tag cost reduction and increase the likelihood of justifying EPC adoption in the more challenging categories.
 - Similarly, EPC-enabled process optimization efforts need to focus on the highest-potential, most accessible opportunity areas across the supply chain.
- 10. Upstream suppliers and third-party logistics and distribution service providers should keep pace with industry adoption.**
- The end-to-end supply chain vision for EPC includes these companies as critical participants. Lack of visibility to product movement between manufacturers and retailers would create a “black hole” in the supply chain, hindering efforts to improve distribution operations, shrink control and related areas.
 - Third-party logistics and distribution service providers also need to adopt the same data exchange and process standards as manufacturers and retailers to facilitate efficient adoption of EPC across the industry.
- 5.3 Actions for the Industry as a Whole to Address Critical Technology Issues**
- 11. Industry participants should work with EPCglobal to prioritize the development of future requisite regulations and standards.**
- More work will be required to gain broad acceptance of the EPC tag standards to meet the needs of global supply chains. In addition, the industry needs to establish a clear roadmap for the development of the different EPCglobal tag classes.
 - Companies should lobby for more harmonized and flexible government regulations on radio technology (including frequencies and power levels).
 - Further development of industry standards and metrics are needed to deliver the EPCglobal Network. Standards for software interoperability and data sharing are still in the early stages of development and need to be accelerated.

12. Industry participants, technology vendors and EPCglobal should work together to make required capabilities available to drive expected benefits:

- Improved EPC tag read rates and accuracy –To help make the EPC vision of automated store and distribution operations a reality. Physics and reliability are two key focus areas.
- High-speed tag application/embedding technologies – Critical to lowering the cost of EPC adoption and enabling the shift to large-scale implementation. High-speed tag reading for the automated handling of cases and other material is a crucial enabler.
- A means of easily exchanging product movement data among companies – Necessary for companies to "scale" new EPC systems and processes to numerous trading partners without excessive cost and complexity.
- New software tools and applications –To enable capabilities such as automated replenishment, manager "alerts" and a more event-driven supply chain.
- A conformance and performance certification process supported by a network of authorized certification facilities (including user locations) –To help companies verify that hardware and software made available in the market conform to EPCglobal standards and local regulations.

In summary, EPC implementation is a substantial investment that requires in-depth, joint planning. Trading partners need to figure out the best path to an EPC-enabled value chain, working together to determine how they can deploy EPC in an economically viable way to achieve an end-state that drives lasting value.

Appendix A: Building the Business Case for EPC

To assist companies seeking to conduct a business case analysis for their specific situations, or to refine an existing business case analysis, we provide in this section an overview of the key *benefit and cost drivers* that would normally be included. In addition, we provide a detailed look at how the benefits are typically calculated in the areas of *improved on-shelf availability* and *improved labor productivity*.

A.1 EPC Benefit Drivers

EPC has the potential to affect all three major drivers of shareholder value: revenue growth, profit improvement and higher capital efficiency. Figure 18 provides a summary of the key benefit categories included in most current manufacturer and retailer business cases, their key operational drivers and the specific Key Performance Indicators (KPIs) affected. These benefits reflect the areas in which leading industry participants expect to achieve positive impact from EPC implementation over the next few years with case- and pallet-level tagging.

Figure 18. Benefits categories and drivers.

Benefit Categories	Drivers	Benefit KPIs
1. On-shelf Availability	<ul style="list-style-type: none"> • More accurate stock data, segmented between backroom and sales floor • Improved replenishment from backroom to sales floor • Improved promotions execution and compliance 	<ul style="list-style-type: none"> • Lower out-of-stocks • Increased sales
2. Inventory Levels	<ul style="list-style-type: none"> • Improved inventory accuracy and visibility across the extended supply chain • Improved, more collaborative demand forecasting 	<ul style="list-style-type: none"> • Safety stock reduction (one-time effect) • Total inventory reduction (ongoing effect)
3. Labor Productivity	<ul style="list-style-type: none"> • More efficient restocking of shelves • Increased accuracy and reduced time for manual activities (e.g., receiving, labeling, picking, stock counting) • Less need for manufacturer sales force to check on retailer stocking compliance (e.g., for promotions) 	<ul style="list-style-type: none"> • Labor cost savings for plant, distribution center and store
4. Claims	<ul style="list-style-type: none"> • Fewer shortage claims (and overages) • Less claims resolution/administration time • Fewer non-compliance charge-backs (penalties) • Fewer losses from returns shortages 	<ul style="list-style-type: none"> • Monetary value of reduced claims • Labor cost reduction (claims administration)
5. Fixed Asset, Capital and Operating Expenses	<ul style="list-style-type: none"> • Improved asset utilization (fewer losses, quicker returns) • Better tracking and management of returnable transport items and logistics assets (totes, roll cages, pallets, etc.) • More efficient use of consumables (labels, etc.) 	<ul style="list-style-type: none"> • Lower capital and operating expenses
6. Shrink	<ul style="list-style-type: none"> • Improved tracking of product movement • Verified shipping and receiving at all nodes in the supply chain • Increased visibility of assets raises the likelihood of detection 	<ul style="list-style-type: none"> • Lower defensive merchandising and shrinkage costs (i.e., higher margin)
7. Transportation Asset Utilization	<ul style="list-style-type: none"> • Reduce loading/unloading time • Improved inter-DC transfers • Quicker turnarounds 	<ul style="list-style-type: none"> • Reduced carrier (demurrage) charges • Increased vehicle utilization
8. Unsaleables/Obsolescence	<ul style="list-style-type: none"> • Improved ability to locate and manage date-coded and obsolete products 	<ul style="list-style-type: none"> • Lower product write-offs and logistics costs
9. Product Diversion	<ul style="list-style-type: none"> • Improved ability to track product movement 	<ul style="list-style-type: none"> • Higher margin on previously diverted products

Source: GCI EPC report participants and IBM Business Consulting Services analysis.

A.2 EPC Cost Drivers

EPC business case analyses typically include the following upfront and recurring costs:

Upfront costs

- **Reader systems** – EPC readers, antennas, access points and motion sensors
- **Software** – Custom software development; packaged software licenses; EPC and other types of middleware; data management systems
- **Integration Services** – Data integration and alignment of data standards; initially identified process/systems changes; integration with legacy systems
- **Infrastructure** – Tag application equipment, label printer servers, EPC data storage and infrastructure upgrades

Recurring costs

- **Tags** – Most likely in the form of "fully converted EPC labels," assumed by most companies to be the preferred approach to tagging pallets and cases in the near to medium term
- **Maintenance and support** – EPC equipment maintenance (including print and application devices, printers, readers, antennas and motion sensors) and replacement of defective equipment
- **Incremental DC/manufacturing labor** – Additional labor expenses that will be incurred until it is feasible to automatically tag at the point of manufacturing for an entire product line
- **Incremental inventory costs** – Likewise, additional costs for holding tagged and non-tagged inventory of the same SKUs, while a mix of tagged and non-tagged product persists

- **Corporate overhead** – Extra staff required to manage and administer EPC-related infrastructure and data.

Total applied tag costs, driven by tag prices and labor costs, are likely to be the key factor in determining the cost and, ultimately, the ability to achieve a positive business case from EPC implementation.

Efforts to drive economies of scale or to achieve process or technological breakthroughs are needed to bring these costs down more quickly. Some industry participants and technology vendors are already investigating how to reduce total applied tag costs more significantly through different approaches to tagging and/or a shift in technology; for example:

- Bare tags (without labels) for applications where no "human readable" data is required
- Tags applied in the manufacturing processes
- Tags embedded in product packaging
- Silicon tags operating at higher frequencies (which enables use of smaller, less expensive chips)
- A shift from silicon-based tags to those based on conductive inks or polymers.

Next, to provide further insight on how companies typically develop projections for EPC benefits, we examine two of the more important categories in greater detail.

A.3 Improved On-shelf Availability

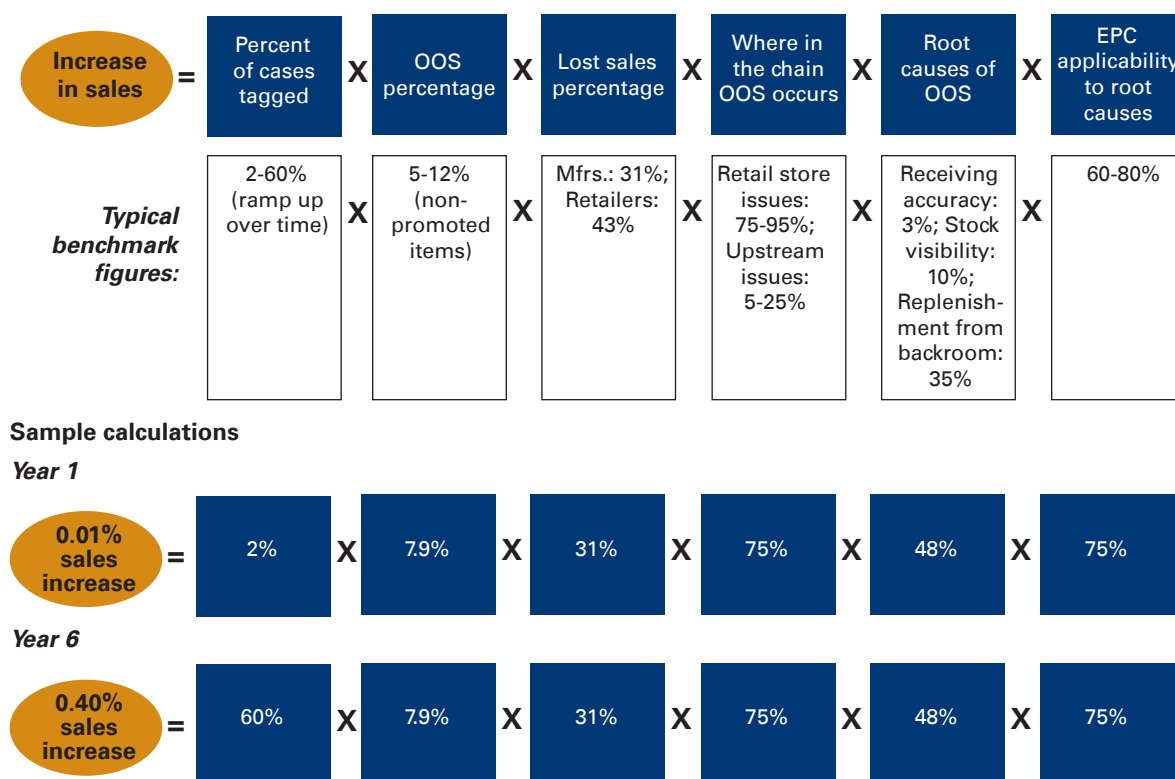
The potential sales lift from reduced out-of-stocks (OOS) is one of the sources, if not the primary source, of benefit from EPC. Quantifying the overall impact in this area

requires companies to take into account a large number of factors (see Figure 19). Among others, these include the typical OOS rate for the specific product category, the percentage of sales actually lost by the company (not all out-of-stocks result in lost sales), and the percent of OOS situations that can be addressed by an EPC solution. Also important is how quickly the company "ramps up" EPC tagging of cases shipped, as projected benefits are lower in early years when the EPC initiative is just starting. Note that the "sample calculations" provided in Figure 19 are purely illustrative and do not necessarily reflect data from an actual business case analysis.

A.4 Increased Labor Productivity

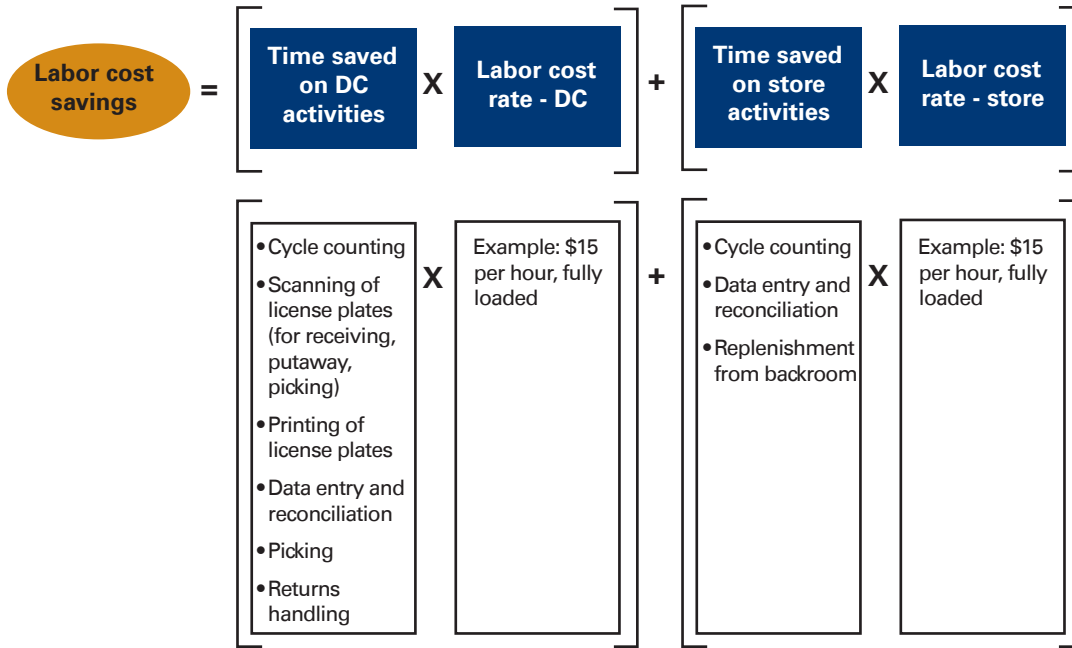
By providing more accurate stock information, better visibility of the location of specific products and greater scanning efficiency, EPC allows companies to increase the productivity of staff in both distribution centers and the store. Some of the specific activities where time savings are expected are listed in Figure 20. The time savings are typically multiplied by an average labor cost rate to obtain an aggregate amount for labor cost savings. Not all of the listed activities apply to all companies, and depending on the level of automation, some companies may see cost reduction in more or fewer categories than others.

Figure 19. Variables used in calculating improved on-shelf availability benefits.



Source: IBM Business Consulting Services analysis and "Retail Out-of-Stocks: A Worldwide Examination of Extent, Causes and Consumer Responses," GMA/FMI/CIES, 2002.

Figure 20. Variables used in calculating labor productivity benefits.



Note: Not all of the listed labor categories apply to all companies, and depending on the level of automation, some companies may see cost reduction in more or fewer categories than others.

Source: IBM Business Consulting Services analysis.

Appendix B: Key References

The authorship team recommends the following references for those wishing to explore key topics and issues discussed in this report further.

- “17 Billion Reasons to Say Thanks: The 25th Anniversary of the U.P.C. and Its Impact on the Grocery Industry.” John E. Nelson and Vineet Garg. PricewaterhouseCoopers. 1999.
- “Automatic Product Identification & Shrinkage: Scoping the Potential.” Adrian Beck, University of Leicester. ECR Europe. July 2002.
- “A Balanced Perspective: EPC/RFID Implementation in the CPG Industry.” Prepared by IBM and A.T. Kearney for the Grocery Manufacturers of America. 2004.
- “ECR – Optimal Shelf Availability: Increasing Shopper Satisfaction at the Moment of Truth.” Roland Berger Strategy Consultants and ECR Europe. 2003.
- “Full-Shelf Satisfaction: Reducing Out-of-Stocks in the Grocery Channel: An In-depth Look at DSD Categories.” Roland Berger Strategy Consultants and Grocery Manufacturers of America. 2002.
- “Guidelines on EPC for Consumer Products.” EPCglobal Inc. http://www.epcglobalinc.org/public_policy/public_policy_guidelines.html
- “Inventory Record Inaccuracy: An Empirical Analysis.” Nicole DeHoratius, University of Chicago and Ananth Raman, Harvard Business School. August 2004.
- “Measuring the Impact of Information Technology on Value and Productivity using a Process-Based Approach: The case for RFID Technologies.” Brian Subirana, Chad Eckes, George Herman, Sanjay Sarma and Michael Barrett. MIT Sloan Working Paper No. 4450-03. 2003.
- “Retail Out-of-Stocks: A Worldwide Examination of Extent, Causes and Consumer Responses.” Thomas W. Gruen, Daniel S. Corsten and Sundar Bharadwaj. Grocery Manufacturers of America. 2002.
- “Shrinkage in Europe 2004: A Survey of Stock Loss in the Fast Moving Consumer Goods Sector.” Adrian Beck, University of Leicester. ECR Europe. July 2004.

Endnotes

- ¹ Cortada, James W. *The Digital Hand*. Oxford University Press: 2004. Chapter 10 provides a historical overview of the adoption of digital computing technologies in the wholesale and retail industry.
- ² Most recycling opportunities rely on item-level tagging of large-ticket items (e.g., appliances and electronics).
- ³ This type of application would require the use of tags with additional functionality for which standards have yet to be defined.
- ⁴ The Enhanced Store Experience and Transformed Customer Experience sections are based, in part, on ideas presented in "METRO Group RFID Innovation Center: Key technology put to the test," METRO AG, October 2004; and "Item-level RFID technology redefines retail operations with real-time, collaborative capabilities," IBM Corporation, March 2004.
- ⁵ "Guidelines on EPC for Consumer Products.": EPCglobal. http://www.epcglobalinc.org/public_policy/public_policy_guidelines.html.
- ⁶ Nelson, John E. and Vineet Garg. "17 Billion Reasons to Say Thanks: The 25th Anniversary of the U.P.C. and Its Impact on the Grocery Industry." PricewaterhouseCoopers. 1999.
- ⁷ Ibid.
- ⁸ Ibid.
- ⁹ The root causes and different levels of impact of out-of-stocks for manufacturers and retailers have been well documented in several recent industry studies (see Appendix B for key references).
- ¹⁰ "Shrinkage: A Collaborative Approach to Reducing Stock Loss in the Supply Chain." ECR Europe. 2003.

About the Global Commerce Initiative

The Global Commerce Initiative (GCI) was established in October 1999 as a voluntary platform. Its objective is to improve the performance of the international supply chain for consumer goods through the collaborative development of best practices and the implementation of global recommended standards.

GCI operates through an Executive Board composed of senior representatives of more than 40 companies drawn equally from manufacturing and retailing that do business across continents or via global supply chains. It operates under the sponsorship of ten organisations representing the interests of far more than one million companies in the world.

For more information on the Global Commerce Initiative and the GCI EPC Working Group, please visit our website at www.gci-net.org or contact:

Dr. Gerd Wolfram
METRO Group
gerd.wolfram@mgi.de

Milan Turk Jr.
Procter & Gamble
turk.mj@pg.com

Sabine Ritter
Global Commerce Initiative
+49 221 947 14 423
sabine.ritter@gci-net.org

About IBM Business Consulting Services

With consultants and professional staff in more than 160 countries globally, IBM Business Consulting Services is the world's largest consulting services organization. IBM Business Consulting Services provides Retail and Consumer Products industry clients with business transformation and industry expertise, and the ability to translate that expertise into integrated, responsive, on demand business solutions and services that deliver bottom-line business value. For more information, visit

www.ibm.com/bcs/retail and
www.ibm.com/bcs/consumerproducts

For more information on this report or our RFID/EPC-related services, please contact:

Sachin Shah
IBM Business Consulting Services
+44 207 021 9444
sachin.shah@uk.ibm.com

Sean Campbell
IBM Business Consulting Services
+1 908 230 2646
sean.campbell@us.ibm.com



Published in association with IBM

© Copyright Global Commerce Initiative and IBM Corporation 2005
All rights reserved

IBM and the IBM logo are registered trademarks of International Business Machines Corporation in the United States, other countries, or both.

Other company, product and service names may be trademarks or service marks of others.

References in this publication to IBM products and services do not imply that IBM intends to make them available in all countries in which IBM operates.

G510-6200-00