

# Why New Technologies Are Reinventing

# Inventory Management

By Malcolm David Bliss and  
Ariel Markelevich, CMA

**O**ver the course of business history, inventories have been labor intensive. The labor associated with periodic inventories is costly, and imprecise counts have made inventory levels uncertain, so companies have maintained needless buffer inventories. They have spent precious time and effort locating products needed to fill orders and assets needed to continue operations.

Today companies are developing new capabilities to manage product and capital asset inventories using Radio Frequency Identification (RFID) and Electronic Product Code (EPC) technologies. RFID removes the need for labor-intensive inventory counts, and EPC provides a unique identification number corresponding to the specific item. Together these complementary, but distinct, technologies are changing the way businesses manage product and capital asset inventories.

RFID and EPC deliver previously unthinkable business results. In food, pharmaceutical, and other quality-sensitive products, improved inventory management is necessary to meet increasingly demanding quality regulations and market requirements. Dominant trading partners are setting mandates for inventory management that affect parties up and down the entire supply and distribution chains. If you take advantage of improved inventory management, you threaten to displace those that don't.

Together, RFID and EPC are ideally suited as a single solution, but each contributes its own costs and benefits. Understanding the distinctions and complementary aspects of RFID and EPC will help in adopting these technologies and achieving the greatest return.

## RFID: Beyond Barcodes

The two main elements in RFID technology are tags and readers. Like labels, RFID tags affix to products or capital assets, but they contain small antennas, radio capabilities, and the ability to store a limited amount of information. RFID readers, which are sophisticated electronic devices, retrieve information contained in the tags.

RFID performs a role similar to barcodes but with important differences. Relative to barcodes, RFID yields an estimated \$0.07 labor savings per item scanned and improves the read accuracy rate by 20%. The business impact of RFID compared to barcodes is the result of these differences:

- ◆ No manual handling is required to read an RFID tag;
- ◆ Hundreds of RFID tags can be read at the same time by a single RFID reader; and
- ◆ RFID tags use radio technology that allows items inside most packages to be read without someone opening the package.

Battery-powered RFID tags are known as active tags. Active tags can be read at relatively long distances (for example, 100 feet), and, among other special functions, companies may use them to report the temperature of an item. Passive RFID tags are the type companies use most often for inventory management. Passive means a tag has no battery and, with high-volume price-per-tag having fallen to \$0.07, passive tags are relatively inexpensive. An RFID reader scans the passive RFID tags via a concept distantly related to an echo. Most RFID tags being used for inventory management today are capable of storing an EPC.

## EPC: Specific Item Identification

EPCs represent a controlled numbering system for specific item identification throughout an entire supply chain. Like Universal Product Codes (UPCs), EPCs identify a manufacturer and a product type. Unlike UPCs, EPCs contain an additional number that's unique to each item. The item-specific identification numbers in EPCs are revolutionary because they present the possibility for every single item in every production facility, in every warehouse, on every shelf, and in every home to be identified uniquely.

Current-generation EPCs consist of 96 bits of information, which means that there are many trillions of trillions of EPCs. That's enough EPCs to identify every individual piece of inventory in the world for the foreseeable future and beyond. Individual EPCs are allocated to organizations by GS1 ([www.gs1.org](http://www.gs1.org)), which is a not-for-profit standards association with a presence in more than 100 countries. It provides EPCs to organizations similar

to the way you receive a website address if you want to host a website.

Once GS1 gives organizations EPCs, they associate them to RFID tags that are then affixed to products or assets. Alternatively, organizations may buy RFID tags with EPCs already coded into them.

## The Business Impact of RFID and EPC

Used together, RFID and EPC enable benefits for asset and product inventory management up and down entire supply and distribution chains by answering the following questions.

### Where Is the Product, and Where Has It Been?

The EPC allows the identification of one or more items in a product inventory. Specifying one or more EPCs is a precise way to indicate which items, cases, or pallets in the product inventory you are looking for. Typically, RFID readers stationed at checkpoints report the location of those tagged items and track the location of each item in a way similar to the way FedEx tracks a package. The most recent report from RFID reader checkpoints indicates where an item or items are now, and prior reports from RFID reader checkpoints indicate where the items have been.

Consider the food supply chain for using RFID and EPC product inventory management. Closely monitoring your food supply chain is important for managing safety and for complying with standards and regulations. If you discover quality issues in one part of the food supply chain, you want to immediately identify other inventories that may be similarly affected and remove all subquality inventory from the supply chain. Effect on brand image, the cost associated with recalls, cost of achieving quality and safety, and liabilities associated with quality and safety lapses are huge business impacts of RFID and EPC in the food supply chain.

Almacafé, the coffee-warehousing subsidiary of the National Federation of Coffee Growers of Colombia, ensures coffee quality by controlling supply, which is an important part of Almacafé's mission. The company's inventory quality system starts when growers attach an RFID tag with an associated EPC to each 100-kilogram bag of coffee beans. RFID and EPC track the product through warehousing, processing, and export. Throughout the logistical chain, the coffee's movement history can be traced all the way back to the grower. At any point in time, there's a current, up-to-date record of how much coffee is in a given facility and the origin of that coffee. This inventory monitoring and control prevents someone

from introducing lower-quality coffee into the supply chain and protects the quality integrity of premium coffee. In addition, RFID and EPC provide precise information about the age of inventory, so coffee beans can be used within a period of time appropriate for a range of end products.

### **Where Is a Capital Asset, and Where Has It Been?**

To find out where a capital asset is, it's important to know specific assets you need to locate. As with tracking product inventory, it's the EPC that identifies a specific asset, and RFID sensors throughout a facility reveal where an asset is at any point in time.

Consider healthcare facilities as an example of using RFID and EPC for capital asset inventory management. You invest significant amounts of money in medical equipment that moves throughout a facility, and you need to locate it quickly. By keeping track of the equipment's location, you also prevent loss and theft. In addition, it's important to track each asset individually to be aware of assets with advanced features, history of use, and maintenance history.

The South Carolina hospital network, Trident Health System, a member of HCA Healthcare, uses RFID and EPCs to track medical equipment in its facilities to make sure it has the equipment available to deliver service at peak times. Trident's thousands of pieces of medical equipment have a value in the millions of dollars. Affixing an RFID tag to each piece of this equipment and installing readers throughout facilities has improved efficiency in locating equipment that has been serviced and is ready for the next use. Using RFID and EPC, Trident has conserved an average of 15 minutes of nursing time per shift and improved utilization of the equipment. As a result, Trident has increased the quality and quantity of care that it provides with its existing staff and equipment. In addition, the technology allows collection of information that improves planning to ensure that the hospital has the right capacity available in subsequent years and avoids unnecessary capital expenditures.

### **Is This Item Authentic?**

High-value products that consumers can't confirm as genuine are subject to counterfeit. As the complexity of the distribution chain increases, so does the risk of counterfeits. When consumers or distributors buy the counterfeit items instead of the genuine products, counterfeit product in the distribution chain can be extremely costly to manufacturers. To avoid these losses, being able to distinguish

between authentic products and counterfeits is key.

You can prevent counterfeiting by assigning a unique EPC, represented with an RFID tag, to each shipped item. Each party in the distribution chain can confirm the item is authentic by reading the RFID tag and checking to make sure that the EPC in the tag is also in a database of authentic products that the manufacturer maintains. If you have no EPC on the product, or the EPC isn't in the manufacturer's database, then the item is a counterfeit.

As an example of using RFID and EPC for product authenticity, consider that you design fashions or manufacture pharmaceutical products. These products are often expensive enough to tempt counterfeiters, and the distribution chains are complex enough that counterfeiters can sneak their products into your supply chain. Consumers may have little or no ability to determine whether a product is counterfeit until long after the purchase.

Take Pfizer, for example. The company sells millions of pharmaceutical units in the United States each year and is using RFID and EPC to thwart counterfeit of expensive, high-demand products. Upon receiving bottles of selected products, wholesalers and pharmacies can verify their authenticity by running a query over a secure Internet connection. The query checks whether the EPC on the bottle matches an EPC in Pfizer's database of authentic EPCs. If the EPC doesn't match the one in Pfizer's records, a counterfeit has been detected, so an alert is sent to appropriate parties in the distribution chain and to Pfizer's Medical Information Services group to coordinate an appropriate response.

### **Do I Have a Complete Collection of Items for This Job?**

Many businesses depend on having the correct inventory of items for a given job or project. The required assortment may vary depending on the job to be undertaken. When an RFID tag with an associated EPC is affixed to each item in the collection of items, a check can be automated to make sure the inventory is complete and appropriate for the job at hand.

Surgery, manufacturing assembly, equipment repair, construction, and computer system installation are a few jobs that require specific equipment and supplies. If you maintain an outside plant and equipment, work crews must attend to a wide range of maintenance and repair jobs, and different jobs require different equipment. For each type of job, a work crew should bring the appropriate equipment inventory to the worksite. If you leave behind a required item, it will cost you time to make an

**Table 1: Summary of Business Questions and Benefits**

BUSINESS QUESTION ADDRESSED	AREAS OF BUSINESS BENEFIT
Where is the product, and where has it been?	<ul style="list-style-type: none"> <li>• Order fulfillment and statusing</li> <li>• Lean inventory management</li> <li>• Quality and compliance</li> </ul>
Where is a capital asset, and where has it been?	<ul style="list-style-type: none"> <li>• Asset utilization</li> <li>• Quality and compliance</li> </ul>
Is this item authentic?	<ul style="list-style-type: none"> <li>• Counterfeit detection</li> <li>• Brand image protection</li> <li>• Quality and compliance</li> </ul>
Do I have a complete collection of items for this job?	<ul style="list-style-type: none"> <li>• Work efficiency and productivity</li> <li>• Loss and theft prevention</li> </ul>
Is removal of this item authorized?	<ul style="list-style-type: none"> <li>• Loss and theft prevention</li> <li>• Quality and compliance</li> </ul>

additional trip to get the forgotten item. On the other hand, if you bring unnecessary items, you might deprive other crews who do actually need them.

Ford, in conjunction with DeWalt Tools, provides a Tool Link option with selected models of pickup trucks. Tool Link confirms that work crews have the correct equipment for the assigned job before they leave a maintenance facility to go to the jobsite. The crews use Tool Link to check equipment in the truck again at the end of the job to confirm that all of it is loaded into the truck. In addition to saving work crews the time to retrieve forgotten equipment items and ensuring equipment items are available for crews who need them, Tool Link helps avoid loss to theft that occurs when equipment is left behind at a worksite.

#### **Is Removal of This Item Authorized?**

Unauthorized removal of items occurs when someone inadvertently forgets to complete a sales transaction or other required procedure before taking the item off the premises. Unauthorized removal of items also occurs when someone steals. In both cases, assets are lost without any compensation, and if losses are material, the balance sheet will need to reflect the adjustments.

RFID and EPC can work together to safeguard assets against loss by using RFID readers to monitor facility exits. As an item approaches the exit, an RFID reader detects the EPC associated with an item. Comparing the EPC to a database of items determines whether the item is authorized for removal. The effect of using RFID and EPC in this way is similar to the effect of using Electronic Article Surveillance (EAS), which is common in retail

environments today, but losses foiled using RFID and EPC result in a specific record of the time and items involved. EAS sounds an alarm when a loss is foiled but doesn't create a record of the items involved. In addition, employing RFID and EPC avoids using labor to remove EAS devices from products at the point of sale.

Utilizing technology such as RFID and EPC to prevent theft returns the greatest benefits when safeguarding high-value items that are most prone to loss. Antiques, musical instruments, and jewelry are good examples of items that are safeguarded by RFID-based security offerings from SNAGG and TAGSYS. To safeguard against theft, retail organizations, such as METRO, a European retailer, are using RFID and EPC in conjunction with a specific item inventory database. Starting with its locations in Belgium, the Netherlands, and Luxemburg, METRO is protecting products throughout the supply chain by attaching RFID tags to individual products and installing readers in facilities from manufacturing to the point of sale.

#### **Financial Considerations**

If you're considering or planning an investment in RFID and EPC, you need to understand your company's own specific costs and benefits. The examples reflect a wide range of purposes and related designs for RFID and EPC deployment. You can use a common set of line items as a start, but there's no one-size-fits-all business case. At the high end, large companies justify investments for production deployments in the millions of dollars. At the low end, justifications for thousands of dollars may be sufficient.

To arrive at a business case for a specific need, start

with benefit line items in Table 1 and the major cost line items we'll discuss. They provide data points and guidance for you to use in preliminary cost planning, but, because prices change, you should consult with providers to get current information for a business case. You can build and validate assumptions and projections for these line items with the assistance of an implementation team whose members bring expertise related to each line item. As a best practice, validate the benefits in your business case in a small-scale, nonproduction, pilot phase before you budget a major capital expenditure.

### **RFID Tags**

If your volume is high, common types of tags will cost about \$0.07 each, and some providers hope to offer tags at \$0.05 each through ongoing technology improvements. At lower volumes, expect that cost to be in the range of \$0.15 per tag.

### **RFID Readers and Related Systems**

Depending on the volume of reads, required read accuracy, and other factors, expect reader systems to cost from \$1,000 to several thousands of dollars for each location where they will be used (e.g., each facility door).

### **Computers and Networks, Deployment, Ongoing Operations, and Maintenance**

The cost for these items varies greatly from tens of thousands to millions of dollars. The application, size of the installation, type of system, and other factors affect the budget for these items. Budgeting for upgrades to existing systems and the involvement of an outside systems integrator may be appropriate.

Companies with existing deployments are expanding them, and other companies are deploying or planning deployment. In all cases, careful analysis is required. To get the most return from RFID and EPC, these top five probing questions can help evaluate deployment plans. Use these questions and others to firm up an initial costs and benefits budget and to validate the budget when planning a major capital expenditure:

- ◆ What is the basis for the projection of labor cost reductions from shipping, to receiving, to warehousing?
- ◆ What are the risks that projections for avoidance of inventory shrinkage won't be realized?
- ◆ What assurances are there that those who counterfeit your products won't find a way to circumvent the EPC identifier and continue counterfeiting even after you deploy?

- ◆ How will RFID and EPC enable the projected reduction in stockouts?
- ◆ Will inventory information be provided to the marketing and manufacturing functions in a way that they can use it, and will they be ready to use it to improve performance?

## **A New Era in Inventory Management**

Labor-intensive, periodic inventories and uncertain inventory levels have long been a part of the standard business model. They have resulted in a drag on business from increased cost of inventory management, maintenance of buffer inventories, stockouts, and poor customer service. Today, RFID and EPC enable a new era of inventory management that provides measurable business benefits through the use of perpetual and specific-item inventories.

RFID and EPC technologies are putting focus on the new benefits of previously impossible improvements in inventory management. The benefits are demonstrated in the traditional role of inventory management in the warehouse, in the stockroom, and on store shelves. Beyond those traditional roles, you can see the benefits of the new era of inventory management in ongoing operations in areas such as managing the inventory of equipment in a given truck and the location of capital assets across a medical facility.

In the past, much has been expended to count inventories and compensate for imprecise counts, but a new era of inventory management has begun. RFID and EPC deployments are becoming increasingly common. As the related infrastructure develops, inventory management will advance to previously unimagined levels of precision and timeliness in supply, distribution, and ongoing operations. That precision will bring a wide range of benefits spanning logistics, quality, brand protection, customer service, and safeguarding of assets. In the new era of inventory management, we'll soon look back on the mainstream inventory systems of today and wonder how businesses could have operated with them. **SF**

*Malcolm David Bliss is a technology strategy consultant at Crown Partners, LLC, working in Cambridge, Mass. You can reach him at [Malcolm.Bliss@crownpartners.com](mailto:Malcolm.Bliss@crownpartners.com).*

*Ariel Markelevich, CMA, Ph.D., is an associate professor of accounting at Suffolk University in Boston, Mass., and is a member of IMA's Boston Chapter. You can reach him at [amarkelevich@suffolk.edu](mailto:amarkelevich@suffolk.edu).*