Radio Frequency Identification (RFID) seems to be in the air these days! As an avid consumer and reader of supply chain management information, I get a lot of it pushed to me via the Internet, as well as from trade publications. The hottest topic is RFID as the next big thing in technology—not as big, but similar to the Internet frenzy of several years ago. Thousands of articles mention it every year. Just this past Spring semester at MIT, we had several students that researched and wrote Master’s theses on various aspects of the use of RFID tags in supply chain management and logistics.

The idea for this column stems from one of these theses, written by Qiang Rose Mei, that discusses the potential impact of RFID technology use on demand planning and customer fulfillment. It started me wondering, what’s really in it for demand forecasters? This was not really a focus area of her research. The bottom line: Not much yet, but get ready.

WHAT’S GOING ON AROUND RFID?

Radio frequency is not a new technology; it has been used for years in plants and warehouses for sending data around wirelessly, as well as for keeping track of rail cars and trailers. The current RFID phenomenon is focused on tiny RFID tags (a subset of auto-identification technologies) that can be put on items for identification purposes. Similar to paper-based barcode labels, RFID tags can be read into a reader/scanner to draw information about a tagged item for input to tracking and tracing systems. However, unlike barcode labels, line of sight is not needed by the reader and it is much faster, requiring little to no manual labor. In addition, while a UPC barcode, for example, might only identify a tagged item’s product type and its manufacturer, RFID tags can have much more information on them. They can also provide information about an individually-tagged item itself, including a history of where it has been. The type of information is virtually limitless in the long run, and this has piqued the interest of many companies that need to move vast amounts of goods around, promising complete real-time visibility and its potential long-run benefits.

In 1999, sponsored by large influential companies, the MIT Auto-ID Center was opened, and was chartered for developing a seamless open network architecture for auto-identification tags. Then, in June 2003, Wal-Mart set the industry into a frenzy when it announced that starting in January 2005, 100 of its top suppliers would need to tag all pallets and cases going to some Wal-Mart warehouses. This mandate would be expanded throughout 2005 to include other parts of its distribution network. The Department of Defense (DoD), Target and Albertsons also followed suite, announcing their future RFID-tagging requirements to their suppliers. Right now, the mandates focus on pallet and case, not on item-level tagging.

WHAT ARE THE BENEFITS OF RFID?

Wal-Mart and the other mandating companies see a great benefit of RFID in improving the efficiency within their own supply chains. They also believe that their suppliers will benefit in the long run, and eventually supply chains and consumers. Much has been written about ways in which suppliers can get benefits from RFID, rather than just being a cost of doing business with these mandating...
For a manufacturing supplier, RFID benefits generally fall into two categories within its supply chain:

1. **Operational Efficiencies**: These RFID benefits accrue in the form of improvements in shipping, receiving, and other handling activities that take place in a supply chain. Goods can be moved around faster and cheaper, as well as tracked in a more accurate and timely fashion. RFID readers require less manual labor, will be less prone to reading errors, and are faster at reading vast quantities of information than barcode and other manual methods currently used for shipping, handling, and receiving. RFID tags can also make recall operations easier.

2. **Integrated Supply Chain Benefits**: The RFID benefits include greater visibility of goods, not only as they move throughout an extended supply network of trading partners — especially downstream from a manufacturing supplier. One long-term promise of this greater visibility will be in the reduction in overall supply chain inventory waste and the lack of product availability caused by the Bullwhip Effect – the bane that amplifies volatility in the upstream demand. A significant portion of the inventory waste and out-of-stock situations emanate from a lack of information about a trading partner’s inventories and customer demands.

**THE BENEFITS FOR DEMAND FORECASTING**

The first benefits dealing with operational efficiencies do not help much to improve demand forecast accuracy, except for the capture of more accurate and timely shipment data. Forecasting methods that rely on the use of historical shipment data will be based on more accurate information, and thus yield greater forecast accuracy. In addition, RFID would allow shipment data to be more easily corrected for returns, mis-shipments, and re-shipments. This should also improve the accuracy of shipment forecasts.

Shipments data, however, is relatively accurate today because financial revenue numbers of a company are primarily based on them. As such, greater benefits to demand forecasting will accrue from the second type of RFID benefits — that is, the integrated supply chain benefits mentioned above. In the long run, more integrated supply chains will reduce the volatility of upstream demand, and this will make demand easier to forecast – so forecast errors will naturally fall over time. (See Figure 1)

However while forecast errors will naturally fall over time, forecasters need not to worry about keeping their jobs,
since the full impact of RFID on these is likely to be 7 to 10 years out. Remember Wal-Mart and others are just piloting today, and they do not require all suppliers in 2005 to comply with the mandate. At the present, they are just mandating pallet and case-level tagging, which without item-level tagging will not drastically reduce upstream demand volatility.

The major benefits of RFID to demand forecasting revolve around the use of multi-tiered forecasting methods, which leverage downstream data to improve forecast accuracy. (See my prior JBF column that discussed it). These methods recognize and deal with upstream demand volatility and its distortion on estimating the true consumption of a product. (See the Kiely article for a good, detailed explanation of the use of downstream information to improve product consumption estimation and forecasting.)

HOW RFID IMPROVES MULTI-TIER FORECASTING

The basic premise of multi-tier forecasting methods is that demand can be better forecast if one understands what is going on in the supply chain after products are shipped to customers and until the final consumption of the products. That understanding can then be used to (See Figure 2):

1. Develop a quantitative downstream model of manufacturer demand as a function of warehouse withdrawals, inventories, replenishment flows, and consumption (i.e., demand at the point of sale).

2. Estimate historical consumption and use it to forecast consumption in the future.

3. Use the quantitative model, downstream data, and the consumption forecast to forecast demand for the upstream manufacturer.

RFID tagging will make it easier to assemble vast quantities of accurate downstream data as an input to this type of multi-tier forecasting process. The data can include warehouse inventories and withdrawals, inventory replenishments, and product consumption. For example, Wal-Mart is promising its suppliers information on products as they arrive and leave their warehouses, stores, and store stockrooms, in addition to the Point-of-Sale (POS) data it currently provides. This type of downstream data will enable a forecaster to:

- Correct demand data for out-of-stock items.
- Understand the lead and transit times in the downstream supply chain.
- Understand how many weeks of inventory are in the sales channels, helping to assess whether there is a surplus or shortage that will impact future replenishment needs.
- Get more accurate POS data from retailers, since RFID tag reading is significantly more accurate than POS scanning operations.
- Measure leaks in the downstream supply chain, including shrinkage and pilferage, to better estimate true product consumption.
- Improve the data gleaned from vendor managed inventory and other co-management inventory programs.
- Better track products sold with and without promotion. This can lead to

![FIGURE 2](https://example.com/f2.png)

(Multi-tier forecasting methods can leverage RFID-enabled downstream information to increase forecast accuracy.)

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more accurate forecasting of promoted products.

WHAT TO DO NEXT

While multi-tier forecasting methods enable a demand forecaster to improve forecast accuracy, they are not often used today. Forecasters, however, are not necessarily waiting for RFID visibility, which could be effectively used in forecasting. Currently-available POS (point-of-sales) data, Vendor Managed Inventory (VMI) information, and warehouse withdrawal data can be used for multi-tier forecasting. I’d advise forecasters to start doing multi-tier forecasting to prepare for fully leveraged RFID-enabled information when it becomes available.

Since significant amount of RFID data won’t be available for at least another two years or so, this should not stop forecasters from implementing a multi-tier forecasting process that leverages the downstream data currently available. Forecasters should soon start piloting and implementing the process, so that they are ready to fully take advantage of the reams of RFID data that will start rolling into their company in a couple of years. In other words, as the Boy Scouts would say: “Be Prepared.” Future forecast accuracy will depend upon it.

REFERENCES

