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ITEM LEVEL RFID FOR APPAREL:
THE DILLARD'S RFID INITIATIVE

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Item-Level RFID for Apparel: The Dillard's RFID Initiative

RFID Research Center:
A sub-unit of the
Information Technology Research Institute
Sam M. Walton College of Business
University of Arkansas
Fayetteville, Arkansas 72701
http://itrc.uark.edu

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Bill C. Hardgrave

Information Technology Research Institute
Sam M. Walton College of Business
University of Arkansas
Fayetteville, Arkansas

Contact:

Dr. Bill Hardgrave
Edwin & Karlee Bradberry Chair in Information Systems
Executive Director, Information Technology Research Institute
Director, RFID Research Center

Address:
Information Systems Department
Sam M. Walton College of Business
University of Arkansas
Fayetteville, AR 72701

(479) 575-6099
bhardgrave@walton.uark.edu

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EXECUTIVE SUMMARY

Item-level RFID has the potential to improve many in-store processes for retailers. In particular, the business case for RFID for apparel retailers looks promising. Previous studies have shown the benefits of RFID at the pallet and case level, such as reducing out of stocks and improving inventory accuracy. It seems logical, therefore, that item-level RFID would provide even more benefits. In this study, we examine the use of item-level RFID at a major apparel retailer, Dillard’s, Inc. Specifically, the use cases of inventory accuracy, out of stocks, cycle counting, and loss prevention are investigated. Results clearly indicate the improvement in inventory accuracy due to RFID. Improved inventory accuracy leads to fewer out of stocks, less safety stock, and better ordering and forecasting, among others. The ability to quickly and accurately conduct cycle counting facilitated by RFID, rather than doing large scale inventories once or twice per year, offers the advantage of keeping inventory accuracy high. Finally, for loss prevention, RFID provides the advantage of knowing exactly what was stolen, when it was stolen, and from where it was stolen. In addition to the insights this provides to improve loss prevention methods, knowing exactly what was stolen allows the retailer to adjust inventory counts accordingly and order more product, as needed.

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Introduction

"RFID in the apparel retail value chain is an item-level proposition, and the place to begin is in the store" (Kurt Salmon Associates, 2006). Based on our previous research on RFID in the supply chain, we, too, believe large benefits – for both the retailer and supplier – can be found at the store. Previous research on RFID for consumer packaged goods retailers has shown a benefit while only tagging pallets and cases – item-level tagging provides even more potential than we have seen in the past.

Item-level tagging is at the heart of "nested visibility" – or, the ability to see products at various levels. Eventually, visibility should be provided at all levels. Currently, in the consumer packaged goods industry, visibility is at the pallet and case level. Subsequently, the product is "lost" when it leaves the backroom for the sales floor and is removed from the case. By starting the investigation at the item-level, one is able to examine the usefulness of the tagging for visibility at other levels (such as using the item tagging as surrogates for case and pallet tagging).

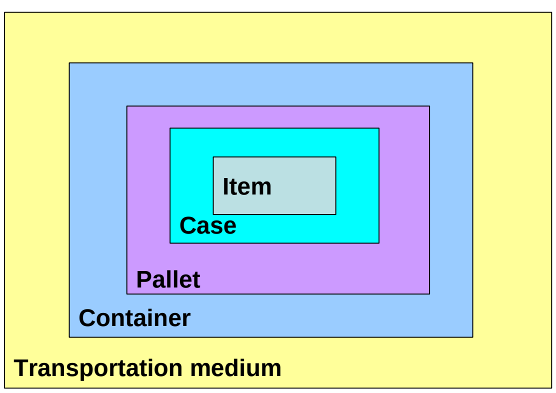

Figure 1. Nested visibility

However, we are not suggesting that RFID benefits end at the store. On the contrary, an investigation of RFID benefits can begin at the store, then push the tagging up the supply chain. Ultimately, the maximum value for RFID is realized when it is used throughout the supply chain at the appropriate level of visibility.

In Phases I and II of this research, we investigated the feasibility of using RFID for item-level apparel/footwear tagging in a simulated environment. Overall, results were positive and suggest that RFID technology is ready to address many of the problems faced in today's retail environment. Ultimately, the true test of RFID is whether or not it creates real business value. Thus, Phase III examines the business value of RFID. Specifically, in this case, various use cases were examined in a natural setting at Dillard's, Inc.

Dillard's, Inc. is one of the U.S.'s largest apparel retailers with annual revenues over $7 billion. The company has more than 300 stores in 29 states in the U.S. (Dillard's Investor Overview, 2009). Dillard's has been a progressive user of information technology and began investigating RFID as early as the mid-1990s. However, it was only recently that Dillard's felt the technology was ready to be deployed.

In this particular study, item level RFID was investigated *in situ*, primarily to determine the effect of item level tagging on inventory accuracy – a known cause of many other problems, such as out of stocks. Cycle counting and loss prevention were also investigated, although they were not the primary foci of the study. Overall, the results can be used to provide guidance to companies as they investigate whether, and to what extent, to implement RFID.

Inventory Accuracy: The Root of all Problems?

The amount of product a retailer thinks they have on hand (also referred to as perpetual inventory or PI) is usually wrong. Many previous studies have shown the inaccuracy of a typical retail store's perpetual inventory, for example 51% inaccuracy (Kang and Gershwin, 2007); 65% inaccuracy (Raman, DeHoratius, and Ton, 2001); and 55% inaccuracy (Gruen and Corsten, 2007). Subsequently, many decisions, such as ordering, forecasting, and replenishment are based on a number that most studies find is wrong more often than it is right!

When evaluating inventory accuracy, there are two basic categories of inaccuracy: overstated and understated. Research has found that about half of the time, inaccurate PI is overstated (i.e., PI shows more inventory than is actually in the store, also known as phantom inventory or understock), and about half the time inaccurate PI is understated (i.e., PI shows less than what is in the store, also known as hidden inventory or overstock) (Gruen and Corsten, 2007). Both types of PI can have a detrimental effect on the retailer. For overstated PI, the most serious and directly related problem is out of stock – the system thinks it has inventory on hand (i.e., phantom inventory), thus fails to order new inventory. For understated PI, the most pressing problem is excess inventory (i.e., hidden inventory) because the system thinks it does not have as much as it really does, thus ordering unnecessary inventory. This unnecessary inventory potentially results in excess holding costs, excessive markdowns which impact margin, reduced turns, and breakdowns in store execution (which can lead to execution-related errors such as out of stocks) due to the inefficiencies created by the extra inventory.

There are several known causes of inventory inaccuracy (Gruen and Corsten, 2007; Kang and Gershwin, 2007; Waller, Nachtmann, and Hunter, 2006). Among the most common causes are theft, cashier errors, incorrect manual adjustments, and mis-shipments. Theft leads to an overstated inventory accuracy problem. For example, the system thinks there are 10 items on hand, but three were stolen leaving a true on hand of only seven. Left alone, this error will grow over time as more items are stolen. Cashier errors can cause both over and understated PI inaccuracy. For example, if a customer is purchasing three items of product A and three items of product B, but the cashier mistakenly enters six items of product A, then the PI for product A will be understated by three units and the PI for product B will be overstated by three units. PI can also become inaccurate due to incorrect manual adjustments by employees. For example, when an employee believes the product to be out of stock, inventory count may be mistakenly set to zero when, in reality, product is in the backroom. Finally, mis-shipments – from the retailers's distribution center or the supplier – are often undetected and can cause PI to be understated and overstated. As an example, four items of product A and four items of product B were to be picked and shipped. Instead, two items of A and six of B were shipped. Now, the PI for both products is wrong. Although there are other things that cause inventory inaccuracy, such as improper returns and damaged/spoiled products, the aforementioned account for most of the problems.

To improve inventory accuracy, companies can do a variety of things. First, companies can conduct physical counts frequently and adjust PI accordingly. Unfortunately, this strategy is very expensive and is less than perfect. Manual inventory counts are rarely, if ever, perfect. Most retailers hope to get 95% accuracy (Graff, 1987), but are rarely close to this desired outcome. Second, companies can let the system adjust PI automatically based on an estimated error rate. For example, if the company estimates that 2% of the items are stolen per month, then the system could make a 2% adjustment each month. The problem with this strategy is that the adjustment factor is difficult, if not impossible, to determine and may provide a false sense of accuracy. Finally, the company can try to eliminate the source of errors by better inventory management, reducing theft, etc. Kang and Gershwin (2007) suggest auto-ID (RFID) as one method to help companies eliminate the source of errors.

Research Methodology

To investigate item-level RFID use cases, four stores were chosen: two RFID-enabled stores and two matching control stores. All stores were in the same geographic region (major metropolitan area in the southern U.S.). For 10 weeks, two times per week (Monday and Friday), physical counts were conducted in two departments (men's denim jeans and women's handbags) in the four stores. A professional inventory auditing group was contracted to perform the counting. The bi-weekly audits were conducted before the store opened and followed the same procedures throughout the study. Inventory on the sales floor and backroom storage was counted. During the course of the study, one of the control stores was closed as part of the overall company's strategy for stores. Consequently, the matching test store was also removed from consideration. Also, for this report, only one department – men's denim jeans – is considered. The lady's handbags were not a central focus of the study and will not be reported here.

Stores were equipped with static readers at the receiving door (i.e., dock doors), employee entrance/exit doors, and customer entrance/exit doors nearest the department of interest. Cycle counting (i.e., inventory) was conducted with handheld RFID readers (in the test stores) and with barcode scanners (in both the test and control stores).

There were between 1100 and 2000 items included in this study. Items were RFID-tagged by the manufacturer; thus, they could be read upon receipt at the store via the receiving door reader. Tags were removed at point of sale and discarded. Returned merchandise was re-tagged by a store associate using a printer/encoder near the department.

The first five weeks of the study were used to determine the baseline. That is, inventory was counted, but RFID data was not used to improve inventory accuracy. During the fifth week, a companywide inventory was conducted in all stores, including the four stores participating in this study (Dillard's takes inventory twice per year). The counts were used to update PI in the Dillard's system. Because of this manipulation to PI data (for all stores), another two weeks of data were collected before using the RFID data to improve inventory accuracy. At the end of week seven, RFID data was used to manipulate inventory accuracy and data was collected an additional three weeks to determine the effect of RFID data on inventory accuracy. Specifically, in the test stores, RFID-generated inventory data was used to update PI. If the RFID-generated inventory count differed from the system count (PI), the system count was updated. This process allowed for a direct test of the effect of using RFID on inventory accuracy. Inventory counts, as determined by RFID reads, directly affected PI.

During the course of the study, metrics were gathered on inventory accuracy (what the system shows versus what was counted by hand or by RFID), out of stocks, cycle counting time, and loss prevention (theft scenarios).

Results

Inventory Accuracy

For each stock keeping unit (SKU) in each store, inventory accuracy was calculated by subtracting the inventory count, as determined by either RFID-read or barcode scan, from the system count (i.e., PI). The results were then placed into one of three categories: perfect (inventory count = PI); understated PI (PI<inventory count); or overstated PI (PI>inventory count). The results, therefore, show the percentage of SKUs that fall into each category (rather than the magnitude of the error for each SKU). Results for the test store are provided in Table 1 and Figure 2; results for the control store are in Table 2 and Figure 3.

Table 1 has three columns: Pre-RFID period, Complete Inventory period, and Post-RFID period. The Pre-RFID period establishes the baseline (as described earlier). To protect information Dillard's deems confidential, the baseline quantity is not provided. However, we are not interested in the baseline quantity. Rather, we are interested in the change to the baseline during the test. In this case, we would expect to see the 'perfect' category improving (+) due to RFID and the 'understated' and 'overstated' categories declining (-) necessarily if perfect improves (i.e., as more SKUs are perfect, less SKUs are either overstated or understated). The Complete Inventory covers the period of time immediately after a full inventory was taken across the Dillard's chain of stores. Finally, the Post-RFID period shows the impact of using RFID data to modify PI.

Test Store	*Pre-RFID*	*Complete* Inventory*	*Post-RFID**
Perfect	Baseline	+17%	+4%
Understated	Baseline	-6%	0%
Overstated	Baseline	-11%	-4%

*cell value represents change from previous period

Table 1. Test Store Inventory Accuracy

As shown in Table 1, the perfect category improves by 17% from the baseline period to the Complete Inventory period. This means that the bi-annual inventory conducted by Dillard's (not related to RFID) improved inventory accuracy by about 17%. We may note that the complete inventory did not correct all errors in PI because of human error. Correspondingly, the 17% increase in perfect was accompanied by a 6% reduction in understated PI and 11% reduction in overstated. (Note: the gains/losses in perfect will always be offset by losses/gains in understated and overstated categories. In this case, 17% gain in perfect = 6% reduction in understated and 11% reduction in overstated.) We want, of course, to see perfect improve and understated/understated decline.

The most interesting result, though, is found the Post-RFID column. Notice how the Post-RFID period improved on the already improved perfect category by 4%. It found this improvement entirely from the overstated category, as it declined by 4% (understated stayed the same). Why did RFID only make a 4% improvement? The answer is twofold. First, this was immediately following a full inventory in which inventory accuracy had been improved by 17%. Thus, it was experiencing a 'ceiling effect'; that is, its opportunity for improvement was limited. Second, the findings for the test store must be considered in relation to the control store.

As shown in Table 2, the control store's inventory accuracy improved by 12% after the complete inventory. The starting values for both the test and control stores were similar ($\pm$ 3%) and the complete inventory accuracy was also similar ($\pm$ 3%); thus, the test and control stores were very similar. Of the 12% improvement, 5% came from understated and 7% from overstated. The interesting comparison, however, comes from the last column. Although the control stores did not use RFID, the same time periods are used to compare both stores; for simplicity, we called the last period 'Post-RFID' for both stores. Recall that the test store increased by 4% during the Post-RFID period, after experiencing a 17% gain from the complete inventory. The Control Store *declined* by 13% during the Post-RFID period. Essentially, all improvement gained from the complete inventory was lost in less than one month! The RFID store, on the other hand, retained the improvement and *gained* more; thus, it is continuing to improve although it was already very good. Thus, when considering the decline in the control store, the improvement in the test store, due to RFID, can be estimated at 17% (4% improvement plus the avoidance of the 13% reduction (4% + 13% = 17%)).

Control Store	*Pre-RFID*	*Complete* Inventory*	*Post-RFID**
Perfect	Baseline	+12%	-13%
Understated	Baseline	-5%	+4%
Overstated	Baseline	-7%	+9%

*cell value represents change from previous period

Table 2. Control Store Inventory Accuracy

Information from Tables 1 and 2 are presented graphically in Figures 2 and 3. From these figures, the changes due to the complete inventory and RFID (in the test store) are obvious. Whereas the tables provided the mean (average) percentages during the three periods, the graphs provide the values during the data collection period over time. From Figure 2, we see that during the pre-RFID period, perfect declines (as one would expect it to do, left unchecked) and then makes a big jump in improvement with the complete inventory (indicated in Figure 2 as the solid vertical line). Then, between the complete inventory and Post-RFID (indicated in Figure 2 as the vertical dashed line), it begins to decline (again, we would expect to see it decline without being manually or systematically manipulated). After RFID, it improves.

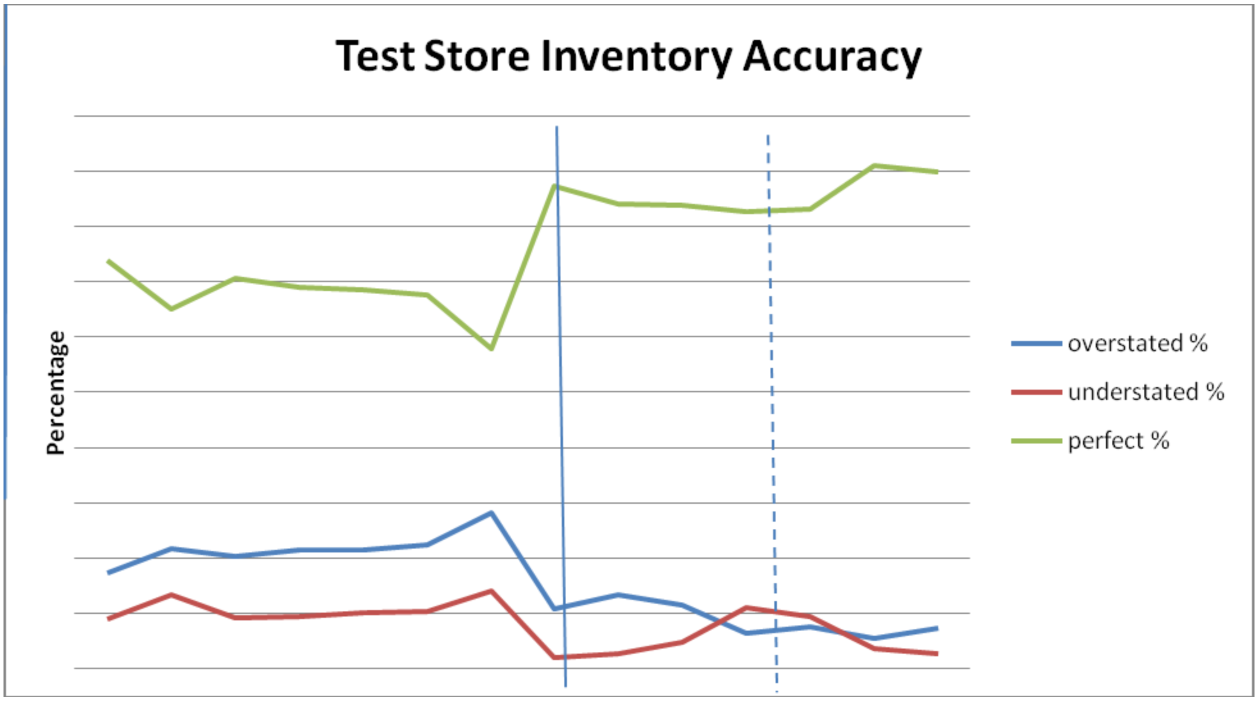

Figure 2. Test Store Inventory Accuracy

Figure 3 tells a similar story until the Post-RFID period. Rather than improving during the latter part of the study (the Post-RFID portion), the control store continues to decline. As reported earlier, the average during this period was a 13% decline. Graphically, it is easy to see that the 13% decline wiped out the 12% gain from the Complete Inventory (indicated as the solid vertical line).

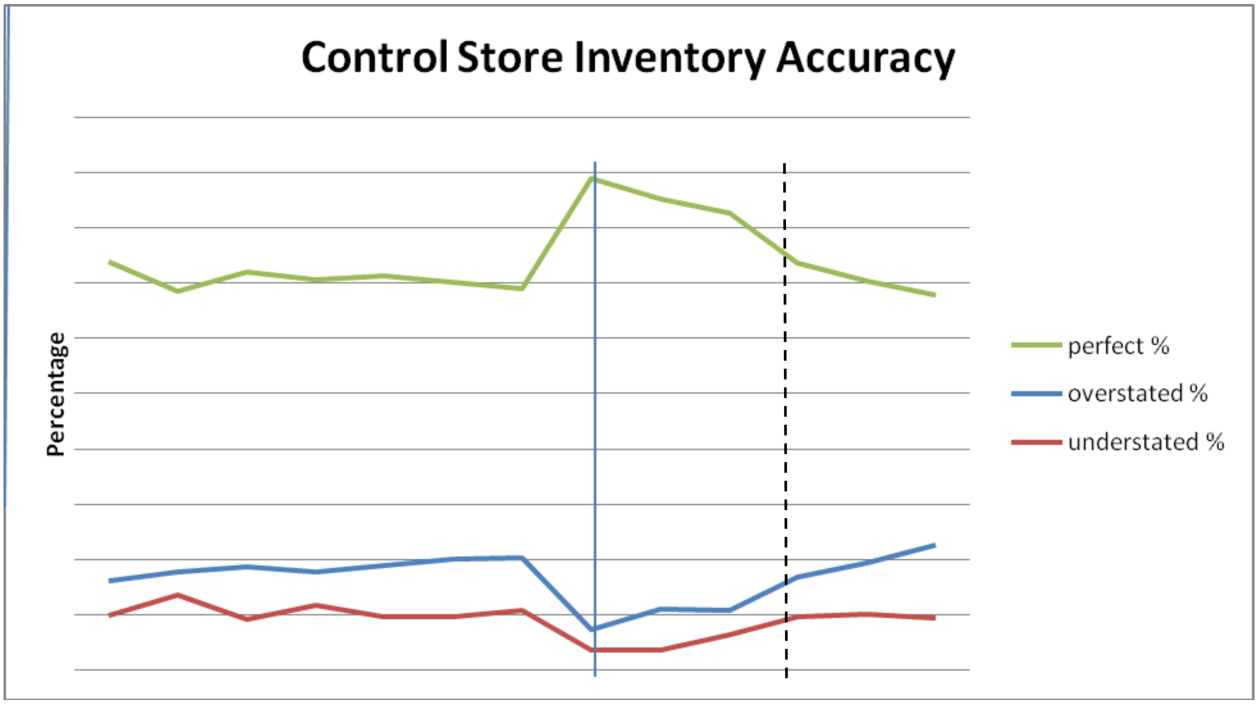

Figure 3. Control Store Inventory Accuracy

Out of Stocks

Dillard's did not use RFID to directly affect out of stocks; that is, no changes were made to replenishment practices nor was RFID used to generate replenishment orders. However, as an illustration of the effect of inventory accuracy on out of stocks, it is worthwhile to investigate out of stock patterns during the time of the study. Figures 4 and 5 show the 'shelf'out of stocks for the test and control stores, respectively, using the same three periods of time from the inventory accuracy analysis (Pre-RFID, Complete Inventory, Post-RFID).

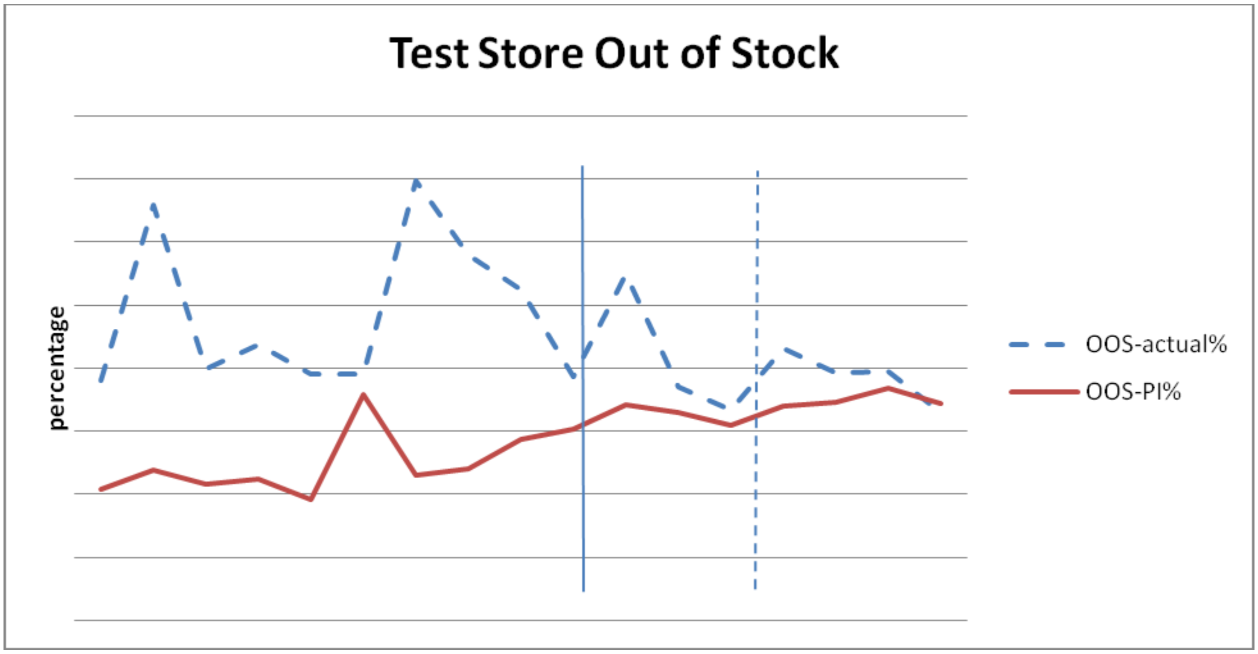

Figure 4. Test Store Out of Stock

In Figure 4, the OOS PI (i.e., what the system thinks is out of stock) is the solid line; the out of stock (OOS) actual (i.e., what is actually out of stock, based on the cycle counting) is the dashed line. Again, we have hidden the exact values to protect confidential information. At the beginning of the study, there is a big difference between what the system thinks is out of stock and what is actually out of stock. The system consistently underestimates the true percentage OOS. The impact on this difference is profound. Let's assume the difference is, on average, 10% (not actual number; used for illustration purposes only). This means that for 10% of the items, the system thinks we have something in stock, but in reality have nothing. Customers may be trying to buy this merchandise, though it is not available. The system shows it is in stock and, if the customer asks for it, the sales associate would most likely look for the item, only to discover the item is nowhere to be found. Certainly, this is a losing proposition for both the customer and the retailer.

Notice, though, how the two lines get closer after the Complete Inventory. As PI becomes more accurate, it gets closer to reality (actual). After RFID, and further inventory accuracy improvement, the two lines converge. Now, what the system thinks is out of stock and what is actually out of stock are in agreement. Thus, the system's automated ordering and forecasting system can do a much better job.

For comparison purposes, the difference between PI and actual OOS for the control store is shown in Figure 5. Note the improvement (i.e., reduction in difference) between the lines due to the Complete Inventory, but continuing divergence thereafter. Left unchecked, as inventory accuracy declined, the difference between the two lines would continue to grow.

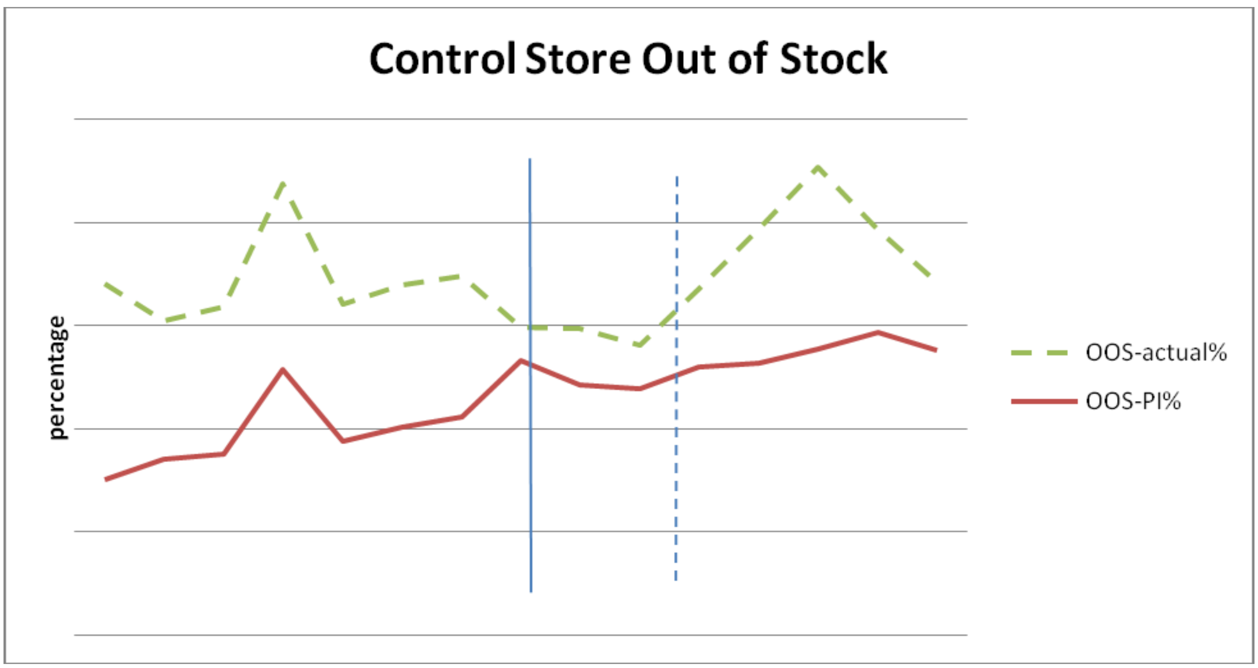

Figure 5. Control Store Out of Stock

In some out of stock situations, the inaccuracy could cause the system to never place an order for a product (because it thinks it has product). Consider the following example: PI = 6, actual = 0, and reorder point = 5. The store has no product to sell (actual = 0); thus, PI will not be decremented (it is stuck at 6) and will not reach the reorder point (of 5). Therefore, the system is 'frozen' and no orders for this product will be issued. This is the ultimate out of stock situation – the store has no product and will not order any product because the system thinks it has more than the reorder point. In Dillard's case, several items were in the 'frozen' state prior to the complete inventory (see Figure 6). After the complete inventory, the number of frozen items drops to zero (which it should), but then begins to increase as inventory accuracy starts decreasing again (as noted in Figures 2 and 4). After RFID, the number of frozen items drops to zero and stays at zero! With RFID, in this case, all occurrences of frozen out of stocks have been eliminated.

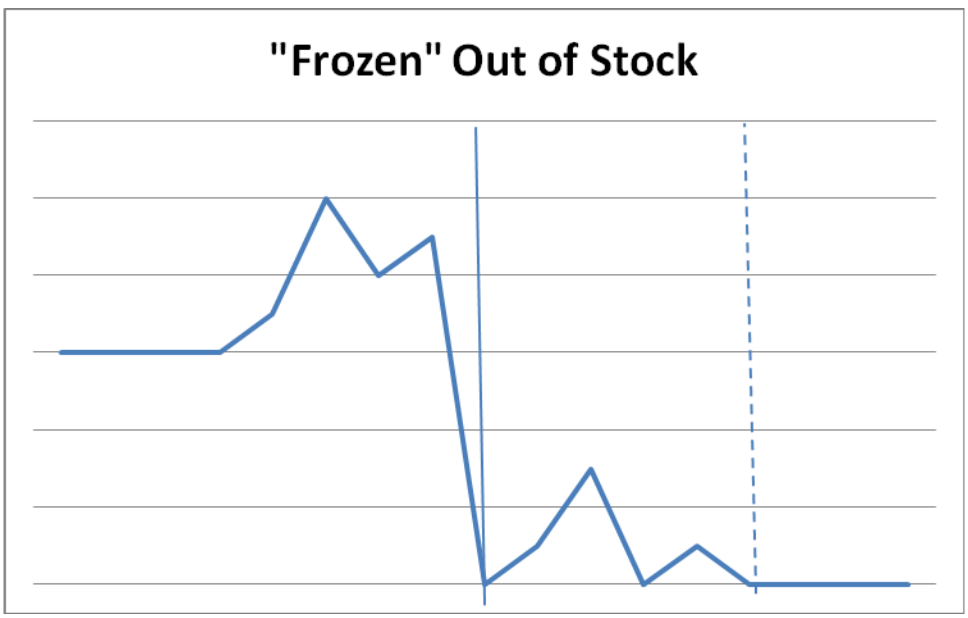

Figure 6. Frozen Out of Stock (Test Store)

Cycle Counting

As demonstrated earlier, cycle counting – either by hand or with RFID – can improve inventory accuracy. This is intuitive – if a retailer counts their merchandise, they know what they have. System generated PI will deteriorate over time if left unchecked. As discussed earlier, events such as theft, cashier error, and incorrect adjustments will cause PI to become inaccurate. One solution to the inventory accuracy problem, therefore, is to cycle count more frequently. Currently, Dillard's does a full inventory two times per year. Perhaps they should increase this to once per week? Of course, this is not practical or fiscally responsible. It takes too long and costs too much to do a hand count of items several times per year for a large retailer such as Dillard's. The key here is 'hand count'. With RFID, it is possible to conduct cycle counting, as performed in this study, more often. Although one may not want to count the entire store, it is feasible to do various departments, as needed. Also, this study used a handheld RFID reader to take inventory. It is possible to take a real-time, continuous, inventory with no human effort; for example, smart shelves and zonal monitoring.

In this case, for comparison, we will restrict our investigation to only cycle counting with a handheld RFID reader versus a handheld barcode scanner. During the course of the study, we tracked the amount of time it took to RFID cycle count and barcode cycle count the same items on the same day in the same store; thus, providing a direct comparison between the two. The number of items varied between 1100 and 2000. Table 3 provides the mean number of items and associated cycle counting times. As seen, with RFID, inventory can be taken in only a few minutes. With barcode scanning, the same items take a few hours. Overall, the net result is a 96% labor reduction of RFID cycle counting compared to barcode.

Mean number of items	Mean RFID cycle counting time	Mean barcode cycle counting time	Improvement
1500	5.5 minutes	2 hours, 18.5 minutes	96% reduction from barcode to RFID

Table 3. Mean Cycle Counting Times

Given the substantial reduction in time to cycle count, retailers, such as Dillard's, could create cycle counting strategies for taking and updating inventory counts on a more frequent basis than once or twice per year. With the above example, Dillard's could take inventory 25 times with an RFID handheld reader in the amount of time it takes to do one inventory with a barcode scanner. This means, of course, they could take inventory one time per week for 25 weeks in the same amount of time it takes them to do one inventory mid-year. Certainly, taking and updating inventory weekly will lead to much higher inventory accuracy than a bi-annual inventory.

Loss Prevention

To determine the potential impact of RFID on loss prevention, two areas were investigated. First, various shoplifting scenarios were evaluated within the store. Second, RFID reads of tags leaving the store (i.e., potentially stolen) were examined.

For the shoplifting scenarios, products were taken (by a tester) from the department to RFID-enabled doorways and the read rates were examined. Specifically, read rates were tested at the employee entrance and at the customer entrance. The employee entrance consisted of a single door near the loading dock with a single RFID antenna overhead. The results of the various shoplifting scenarios are provided in Table 4. For these tests, the tester did not try to optimize testing outcomes. Rather, a realistic environment (as close as possible) was provided such that the tester tried to defeat the RFID read. For example, the tester grabbed 10 pair of jeans and ran out the door while holding the items close to the body and shielding the product from the antenna – things that are known to adversely affect read rates. Multiple tests were conducted for each scenario; table 4 shows the mean of the various tests. In almost all cases, RFID was very successful (at or near 100% read rates) in detecting the ‘stolen’ merchandise. In only one scenario – two jeans concealed under the arm while running – did the read rates drop below 90%.

Test Store -- Employee Entrance	**Read rate**
10 jeans carried in stack; walking	100%
10 jeans carried in stack; running	90%
2 jeans in bag; walking	100%
5 jeans in bag; walking	100%
1 jeans concealed under arm; walking	100%
2 jeans concealed under arm; running	50%

Table 4. Shoplifting Scenarios – Employee Entrance

For the second test, the same set of shoplifting scenarios were conducted at the customer entrance. The customer entrance was nearest the denim section and consisted of seven doors with four RFID antennas overhead inside the suspended ceiling. Results of this set of tests are show in Table 5.

Test Store -- Customer Entrance	**Read rate**
10 jeans carried in stack; walking	93%
10 jeans carried in stack; running	67%
2 jeans in bag; walking	100%
5 jeans in bag; walking	100%
1 jeans concealed under arm; walking	0%
2 jeans concealed under arm; running	67%

Table 5. Shoplifting Scenarios – Customer Entrance

Similar to the customer entrance tests, multiple tests were conducted for each scenario and the means are reported in Table 5. As shown, three tests were excellent, exhibiting read rates greater than 90%: 10 jeans walked through the door, 2 jeans in a bag walked through the door, and 5 jeans in a bag walked through the door. The tests of 10 jeans ran through the door and 2 jeans hidden under the arm produced 67% read rates. For one pair of jeans, the tester was able to completely eliminate the ability to read the product by placing the jeans under the arm. Overall, in a situation involving a wide area (7 doors) with only a few antennas (4), the read rates were good. It is also wise to compare these readings with a non-RFID situation which would provide no visibility into what was actually stolen. An electronic article surveillance (EAS) system would likely sound an alarm for these scenarios (with the exception of the one pair of jeans under the arm), but could not provide an indication of the exact items that were stolen.

For the final examination of RFID's impact on loss prevention, RFID data, generated from key read points were used to provide loss prevention insight. As described earlier, the tags were removed at point of sale. Thus, any tags seen at the employee or customer entrances would be potential theft occurrence or store associate error (i.e., they failed to remove the tag). To eliminate the latter from consideration, each RFID read from the employee and customer entrance was matched against a point of sale for the same product. If a match was found, then the read was attributed to store associate error. If no sale of that product was found, then it was considered a theft occurrence. Over the course of a few weeks, more than $3,500 in merchandise was deemed stolen, based on the above approach. For this merchandise, the retailer is provided two key pieces of information. First, the retailer knows exactly what, when, and where (i.e., employee or customer entrance) was stolen. This can be used as insight into instituting proper loss prevention methods. Second, the retailer, by knowing exactly what was taken, can adjust PI accordingly and, if appropriate, order more merchandise to replace the stolen items. Too often, PI will continue to show product available for sale when it is not. No product for sale and nothing on order means no sales for the retailer.

Discussion

The evidence presented herein is based on an extensive test at Dillard's, Inc. As such, it provides great insight into the effects of RFID on inventory accuracy, in particular, and out of stocks, cycle counting, and loss prevention, secondarily. RFID appears to be making a difference. By tagging the items in the selected department, Dillard's was able to improve their inventory accuracy substantially. One could, however, argue that RFID is not needed to improve inventory accuracy – one could simply increase the number of physical inventories and associated manual adjustments to keep inventory counts accurate. This argument is logically sound – except, at what cost? By providing an environment where inventory can be taken efficiently and effectively with RFID, inventory accuracy can be maintained. High inventory accuracy will lead to fewer out of stocks and, ultimately, higher sales. Glimpses into RFID's utility in loss prevention were also provided. In this case, identifying what/when/where something disappeared helps the retailer develop plans to reduce loss.

Why is this RFID-enabled reduction in inventory inaccuracy important? Understated PI can cause the system to order unnecessary inventory. This unnecessary inventory, in the form of safety stock ordered to cover the uncertainties in the supply chain, costs suppliers and retailers money and decreases the efficiency of the supply chain. Inventory inaccuracy is a form of uncertainty in the system. The (Q,R) inventory policy used by many retailers (where Q items is ordered when R items [reorder point] is reached) provides low stockouts and low inventory *if* inventory counts are accurate (Kang and Gershwin, 2007). Because PI is often inaccurate, additional inventory is held to lower the risk of stockouts. On the flipside, overstated PI leads to potential out of stock situations. In department stores, such as Dillard's, theft is an ongoing issue. As discussed earlier, theft leads to overstated PI (e.g., system thinks 6 units are on-hand, but 2 were stolen, so actual is 4). When the system thinks it has inventory but, in reality, does not, out of stocks occur. In some situations, as demonstrated, the inventory can become ‘frozen’ and no orders will be placed for new product.

Overall, this study has examined and demonstrated how RFID can reduce PI inaccuracy. With more accurate PI, supply chains may be expected to operate more efficiently, resulting in lower costs, higher levels of in-stock, higher sales, and increased customer satisfaction.

Conclusion

Inventory accuracy is one of the keys to an efficient and effective supply chain (i.e., ordering, replenishment, etc. are based on an accurate inventory count). Yet, inventory accuracy is often poor -- about 65% wrong – thus, more wrong than it is right. RFID is a technology that provides promise in improving inventory accuracy. Subsequently, this study investigated the use of item-level RFID to improve inventory accuracy. For 10 weeks, inventory was tracked in the denim department of two Dillard’s stores (one test, one control store). The results suggest that, indeed, RFID is making a difference. Inventory accuracy in the test store, relative to the control store, improved by 17%. Subsequently, the store had better information regarding its out of stocks and the most severe form of out of stocks – ‘frozen’ inventory – was eliminated. Tests also revealed the insight item-level RFID can provide in loss prevention.

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