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Case #6-0020

Woolworths "Chips" Away at Inventory Shrinkage through RFID Initiative

Introduction

Geoff O'Neill smiled as he sorted through the pile of magazine and newspaper articles littering his London office. 2003 had been a great year for O'Neill. As the head of central logistics for new sales channels at Woolworths plc, he had received the *Supply Chain Solution of the Year Award* at the *European Retail Solutions Award Conference* for his successful implementation of a ground-breaking Radio Frequency Identification (RFID) inventory tracking system. Reporters from both the US and Europe had visited his distribution center to see the system in action and hear how O'Neill had brought many leading edge technologies together to build the first such commercial tracking system. Yet, despite accolades from the press and the program's initial success, O'Neill knew he still faced a difficult question. Should he recommend that the RFID program be expanded? Could he convince Woolworths executives that RFID was a "low-risk" technology ready to move beyond the "sandbox phase" and into Woolworths' entire supply chain?

O'Neill believed that Woolworths should move forward with a full scale tracking system that would cover the entire distribution network. And while the investment would be significant, he was certain the return would be equally significant. However, he knew that his convictions were not enough. Press clippings, gadgets, and buzzwords such as "increased visibility" would also not be enough to convince senior management to make the £3 million investment. O'Neill had to present a sustainable business case that demonstrated his organization's ability to build upon the current savings, leverage the work to date, and generate a strong return on investment (ROI).

O'Neill glanced down the darkened hall outside his office. The building was quiet, with many still enjoying the New Year's holiday. For him, the excitement of the holiday season was over and the cold realities of January 2004 hovered in his mind like the fog outside. The yellow pad on his desk had the scribbling of an impressive business case for RFID. But O'Neill could not help but wonder, was the case compelling enough to divert precious capital from other important projects?

This case was written by Center for Digital Strategies MBA Fellow Mike Gozycki and Professor M. Eric Johnson of Tuck School of Business at Dartmouth and Professor Hau Lee of Stanford University. It was written as a basis for class discussion and not to illustrate effective or ineffective management practices. Version: June 19, 2004.

Background

Back in 1999, before most people had even heard of RFID, Geoff O'Neill implemented one of the first security systems for tracking individual products. The project, which involved tagging clothing moving from a distribution center to a single store, was not a huge success. The tags were too expensive, too unreliable, and did not provide the read range the company needed. On the positive side, the experience gave O'Neill a taste for the technology and he was certain that RFID had the potential for solving many important supply chain problems. He felt that better visibility of product flow could help reduce inventory levels; increase the accuracy of orders shipped to stores, and cut theft of goods in transit.

In May of 2000, slightly less than a year after his initial attempt, O'Neill saw an opportunity to give RFID another try. The UK government's Home Office sought corporate participants for its initiative to reduce crime. The Home Office argued that stolen merchandise funded many other crimes and that by better securing the supply chain, crime could be reduced. To directly address the retail theft issue, the Home Office unveiled the *Chipping of Goods* initiative, a program designed to reduce the problem of inventory shrinkage.

Inventory shrinkage was one of the major issues confronting the retail industry, with losses in 2000 amounting to some €30 billion across Europe[1]. Woolworths estimated that it lost about £75 million each year to theft. Shrinkage problems stemmed from many sources including incorrect shipment deliveries, stock losses in the distribution center, theft of goods in transit, and shoplifting within the stores themselves. According to industry studies, roughly 56% of this loss was a result of internal process errors and theft from within the supply chain. The remaining 44% was the result of shoplifting in stores. To combat shrinkage and property theft, the *Chipping of Goods* initiative co-financed identification programs for expensive, vulnerable items such as clothing, cell phones, laptop computers, and CDs. By subsidizing part of the implementation costs, the UK Home Office also hoped to show that positively identifying the owner of the goods, from the point of manufacture through the supply chain to the retail stores, would not only reduce property crime, but would also provide business benefits.

The Home Office didn't need to convince Geoff O'Neil. He immediately recognized the potential business benefits and proposed a system that would meet the Home Office criteria of (1) addressing the UK's property crime problems; (2) using RFID technology; and (3) benefiting the entire retail industry. Based on this proposal, the UK Home Office selected Woolworths for the pilot program. When the award was announced in 2001, an optimistic O'Neill stated;

> "We are pleased to be associated with this prestigious, forward-thinking Home Office initiative. This is more than simply a supply chain security measure as it also has the potential for better stock management and improving on-shelf availability for our customers, which has historically been an issue for Woolworths. Currently, a lack of visibility makes it impossible to identify exactly where this shrinkage occurs and to attribute this to operational procedures, stock losses in the

[1] In January 2004, £1 = €1.4 = $1.8.

> distribution center (DC), losses in transit, or from within the store. Not only does the project address shrinkage but also brings greater levels of visibility to the supply chain. This visibility generates a wealth of previously unavailable information about Woolworths' supply chain operations which can be used to streamline processes, reduce costs and provide better service and product availability to customers."

With partial funding from the UK Home Office, O'Neill set out to implement a system that enabled the company to track products from the time they left the distribution centers until the time they arrived at a specific store.

Woolworths Group plc

F. W. Woolworths, a subsidiary of its US parent, was founded in the UK in 1909 as part of its parent company's global expansion plan. The first store opened in Liverpool, beginning a rapid roll-out throughout the UK. While Woolworths may have begun in the United States, it quickly became one of the UK's most loved retailers. Focused on product lines for the home, family, and entertainment, Woolworths always offered its customers excellent values on a wide range of products. F.W. Woolworths was subsequently listed on the London Stock Exchange with its US parent retaining a majority shareholding. In 1982, Woolworths was acquired by Kingfisher, Europe's largest home improvement retailer. Following the acquisition, the new management implemented a strategy to focus the product offering, centralize accounting, invest in new information systems, rationalize the store base, reduce costs, and centralize distribution. Products were rationalized into clearly defined categories: entertainment, home, kids (toys and clothing) and confectionery. This enabled further development of the individual product ranges through the use of branded, own-brand and exclusive merchandise such as Ladybird Clothing and Chad Valley Toys.

In the late 1990s, the management extended the Woolworths brand into other retail formats and alternative channels to accelerate growth by taking advantage of changing retail trends. This resulted in the opening of the first Big W store in 1999 and Woolworths General Store in 2000.

Woolworths was divested from Kingfisher plc in 2001 and began trading on the London Stock Exchange. The divestiture enabled the Woolworths Group plc management to pursue (independently of Kingfisher) the recovery and growth strategies that best met its long term objectives. In 2004, Woolworths maintained a portfolio of approximately 900 stores. Over 800 Woolworths, Woolworths General Stores, and "Big W" superstores offered housewares, toys, sweets, apparel, home electronics, and seasonal fare. The Group's other retail outlets included MVC home entertainment and electronics boutiques (about 85 shops), EUK, the UK's largest distributor of home entertainment products, and music and video publisher VCI.

Woolworths faced increased competition from all sides. Traditional UK grocery retailers such as Sainsbury and Tesco had aggressively expanded their offerings beyond traditional food items. Pharmacy chains such as Wilkinsons and Boots the Chemist had expanded their general merchandising offerings. Finally, Woolworths' "Big W" supercenters faced

competition from Wal-Mart, which established a UK presence through its purchase of ASDA. This increased competition placed a great deal of pressure on already thin general merchandise margins. Woolworths' sales in 2003 totaled some £2.7 billion in confectionery, toys, stationery & events, entertainment, clothing and home items (see Exhibit 1 for financial information).

The Technology of Tracking

Radio Frequency Identification (RFID) was an evolving technology that could be used to track assets of any type. The technology was enabled by small radio transponders, called "tags," that were attached to the objects being tracked. The tags communicated with a reader (or antenna) much like a cell phone communicates with a tower antenna. When a tag was within range of the reader, they could communicate. The reader then passed information about the object to a host computer that processes the information and, in turn, passed the information to application servers over the internet. Therefore, as the tagged objects moved in the supply chain, the movements became visible to managers through a web-interface.

RFID tracking had several benefits over traditional bar coding. First, it did not require physical line of sight. That permitted the instantaneous "scanning" of many pallets and cases fitted with transponders that passed through a dock door equipped with an RFID reader system. Bar codes required each item to be scanned individually, which consumed more time and required specific positioning of labels. A second benefit was the automated nature of RFID. No human intervention was required, which made the system more reliable and harder to manipulate. Finally, more information could be stored on a tag and, depending on the technology employed, the information could be dynamically changed and updated.

In 2004, RFID tags used in supply chain applications were available in many different configurations, employing different technologies that had cost and performance trade-offs. The tags could be broadly segregated into two major classifications: passive and active. Pure passive, or "reflective," tags did not contain an internal power source and were less expensive. These tags had a very short range (1-3 meters) and relied on the energy radiated by the reader to power the circuit. For example, to track merchandise leaving a warehouse, readers could be positioned at the dock doors. As tagged merchandise came within the range of the reader, the readers would send signals to the tag and the tag would respond by transmitting its unique identification number. That number could be associated with the merchandise, so the system could quickly identify the merchandise and record its movement. These tags cost anywhere from £0.1 to £10, or more, depending on the technology, data storage capability, and operating range of the tag. Readers, on the other hand, typically cost £500-2000 depending on their connection requirements. Wireless readers, used in outside applications, were more expensive while ones that could be connected by cable inside a building were at the lower end of the cost range.

Active tags contained both a radio transceiver and a battery. They had a substantially larger range (100 meters) and were more reliable, but were also more expensive, and required battery replacement periodically. Active tags had the ability to transmit their location and other information intermittently with the signals being monitored by readers in the vicinity.

Active tags could store far more information that could also be updated through interaction with the reader. Simple active tags cost as little as a few pounds or hundreds of pounds, again, depending on the technology, range, and capabilities. Readers also ranged in cost from £500 to £5,000 or more for tower readers in outside applications.

Pilot Project Description

Woolworths serviced the general merchandising needs of its 800+ stores through four distribution centers (DCs).[2] Two primary distribution centers, located in Castleton and Swindon, were geographically focused, carried the same "general merchandise" items, and serviced approximately 400 stores each (Exhibit 2). The two seasonal distribution centers, located in Rugby and Chester, carried a revolving inventory of seasonal merchandise including everything from patio furniture to Christmas decorations. Merchandise bound for the stores was typically transferred to the stores in either a large steel roll cage or a reusable plastic tote box. Large items were shipped in one of 100,000 roll cages while smaller items where shipped in totes (Exhibit 3). Totes destined for the same store were stacked on one of 16,000 dollies (roll cages without sides). Distribution Center employees wheeled these roll cages and dollies onto trucks for delivery to the stores.

O'Neill's initial challenge for the pilot project was to define a manageable scope in terms of the products, vehicles, stores, and distribution centers to be included. Woolworths distributed the dollies and their associated totes (up to 10 per dolly) only from its Swindon warehouse; all 800+ stores were covered from this site. Therefore, this closed-loop was ideal for a "proof of concept" and did not require tagging all 100,000 roll cages. The system would track these dollies (and the associated totes) out of the warehouse, to the stores and back again.

From Woolworths' previous RFID initiative, O'Neill knew that item-level tracking, the "holy grail" of supply chain management, was not feasible. The £4 average "basket" price[3] did not support a £0.25 passive chip implementation. However, O'Neill believed that a unique "Russian Doll" strategy could achieve item-level visibility without item-level tags. The strategy combined a number of technologies focused on reducing both process losses and theft from the point of pick through the point of delivery to store, including:

- Bar codes on the individual items and on the tote boxes.
- Short and long range RFID devices to track movements within the DC.
- Portable RFID readers to track movements from the DC to stores.
- Global Positioning System (GPS) to track vehicles on route.
- A Wireless Wide Area Network (WAN) to transmit data back to the control system.
- 16,000 active RFID tags.

[2] Woolworths maintained a fifth Distribution Center that provided all assembly and distribution functions for the retailer's apparel offerings.
[3] Basket price refers to the average purchase amount per customer visit within its retail stores

- Integration services with Woolworths' fulfillment and transport planning systems.

By using this unique combination of technologies, Woolworths had complete visibility of the movement of each tagged dolly, increasing security of both product and distribution assets (See Exhibits 4 and 6 for a detailed description of the technologies used).

The outbound distribution process began in Woolworths' national distribution center in Swindon via two technologies:

- ***Automated Storage and Retrieval System***. A high density rack retrieval system that used automated robots to stock merchandise stored in plastic totes on the shelves and later extract merchandise bound for the stores. This process, which required no manual intervention, was used primarily for high-value items (See Exhibit 4). Totes retrieved from the rack were sent to a picking area where items were sorted for each store order.

- ***Pick- to-Light System***. Employees selected small items destined for each store using a pick-to-light system that resulted in better than 99 percent accuracy. In the pick-to-light system, workers were guided visually by lights to the exact bin locations where the required articles were stored (see Exhibit 4). These items were picked and placed into plastic tote boxes. In cases where the tote held high-value items, the entire tote would be shrink-wrapped to discourage theft.

All of the plastic tote boxes had unique bar codes. Totes destined for the same store were scanned and then stacked on dollies using an automated stacking system. In the past, the dollies had no unique identifier. For the pilot, Woolworths attached a Savi EchoPoint™ active (battery-powered) RFID tag on each dolly (see Exhibit 4). The simple active tag was developed by Savi Technologies to be low cost (about £5) and was disposable with a battery life of about 4-5 years.

The dollies were recorded as they moved toward the dispatch bay. A short-range device, called a SignPost, located under the track of the sorting system, emitted a low-frequency signal that activated the RFID tag. To conserve energy, the tag spent much of the time in a suspended state until it was activated by a sign post (or reader). When activated, the tag broadcast the information it contained, which was read by long-range readers installed in the rafters of the building (readers could recognize tags from up to 100 meters away). The software system associated the bar codes that were scanned on the totes with the RFID tag on the dolly. So the system knew which items were put in specific totes and which specific totes were put on a specific dolly.

Woolworths also tied Savi's SmartChain real-time logistics platform in with its transport planning system. That way they could track which vehicle was in the dispatch bay at a given time and the destination of the vehicle. Medium-range SignPost readers, which could wake up a tag from about 20 feet, were installed over the dispatch bays. When the dispatch bay team loaded dollies onto a vehicle, the tags on the dollies were activated and read, and the system compared the ID numbers to the truck's delivery instructions. If the wrong dollies were being loaded, the system alerted staff with flashing lights (see Exhibit 5).

Once the vehicle had been loaded with the right dollies, the doors on the truck were closed and an encrypted seal (an electronic lock activated by a randomly generated code), was placed on the doors. The code had a four-digit number that the driver punched into his handheld computer. The vehicle was then ready to make its first delivery. Each driver had his own portable kit that included a Symbol PDT8100 handheld scanner (see Exhibit 4). The unit also had a GPS transmitter, so Woolworths could track the truck's movements between the distribution center and the store. The GPS transmitter was set up to send a signal at different intervals along the trip. Since the cost of monitoring was based on how often the transmitter broadcasted, the interval could be lengthened if the goods in transit were inexpensive, or set for every five or ten seconds if there was high-value merchandise in the truck.

When the driver arrived at the store, he keyed in a four-digit number used to identify the particular store and the system would confirm his exact location by "geo-fencing". If he said he was at store 1234, the system knew the location of that specific store and confirmed that he was at the correct location. He then entered the four-digit seal number, which was required to correspond with the number that was entered at the dispatch bay. If the code did correspond, the lock was released, and he was then given instructions on the handheld regarding which dollies and totes to unload. As he unloaded each dolly, the driver would scan it with the Symbol unit. The system would then confirm that he moved the correct dolly or tote. The system would warn him if he had delivered too many, too few or the wrong ones.

Once delivery was complete, the driver then received an electronic signature from the store manager on the screen of his PDT8100, indicating that the store had received the entire shipment. He would also accept any returns that might be going from the store back to the distribution center and then close the transaction by securing the vehicle door and entering the seal number. When he got back into the vehicle, he connected the PDT8100 to its base station, and the information from the transaction was transmitted via the Mobitex wireless network into Microlise's Transport Management Center. From there, the data was forwarded to the Savi SmartChain platform where the asset movement history was recorded. The driver would then move on to the next drop and the process was repeated. This completed the audit trail.

The system could track dollies going to any of Woolworths’ stores in the UK. The pilot, however, only equipped fifteen trucks with the Symbol handheld computers with GPS transmitters. Consequently, the company could only track shipments to 30-40 stores.

The SmartChain tracking platform formed the focal point of the tracking process. Hence the existing enterprise systems also fed data into the SmartChain tracking platform. For instance, the tote-pick control system told Savi SmartChain which picks and which tote boxes were going in each store order. The transport management system provided the SmartChain software with information about which store order went on which vehicles when the vehicles were in the dispatch bay. The SmartChain platform brought all the data together to keep track of which picked items went into which tote, which tote went onto which dolly and which dolly onto which vehicle (the Russian Doll).

Woolworths purchased Savi's EchoPoint tags for each of the 16,000 dollies in the system. Although the original goal was to track only high-risk merchandise, like expensive clothes and CDs, the company decided to extend the system to all items shipped using the dollies. O’Neill explained this decision saying; “The beauty of the way we've set up the system is that you can afford the same level of protection to lower-value merchandise as you can to mobile phones and electronics that go through the same system. So your low-value merchandise gets covered as well as your high-value items.”

In addition to the fifteen PortaPOD mobile units used to relay real-time data back to the Transport Management Center, Woolworths also equipped two stores with fixed RFID units to track dollies from the distribution center. The mobile PortaPods units, however offered greater flexibility and could be used to track vehicles (and therefore their contents) via GPS throughout the trip from Distribution Center to the store.

Benefits

This project demonstrated the ability to integrate a unique combination of technologies (bar codes, short and long range RFID, WWAN communications, GPS and existing order fulfillment systems) and deliver useful information and visibility to an extended supply chain. This was done in such a way as to be almost invisible to the user unless there was an error (almost all information was gathered automatically and only when there had been loading or delivery errors did the system notify the user).

Although the project covered only a small proportion of the goods delivered to the stores, it demonstrated the capability to have complete visibility of all goods from the moment they were picked, in transit, and delivered to the store. The project eliminated incorrect deliveries of dollies to the participating stores (i.e. process errors and potentially criminal activities) and also provided useful information in the event of a criminal investigation. The system had also been designed in such as way that it could easily be extended to cover more stores and also include merchandise in roll cages.

Woolworths identified six categories of benefits:

1. Shrinkage. Through better visibility of inventory and its whereabouts, process/delivery errors were identified and corrected on a real time basis. The new system also provided an automated audit trail in the event of losses.

2. Bookstock Accuracy. A real-time, automated update of book stock within stores made stock records more accurate. This in turn enabled higher availability from lower inventory levels thereby improving customer service.

3. Reduced Labor Costs. The automated inventory verification process reduced manual check-in and updating of stock records. The increased accuracy also reduced the effort required to investigate stock losses.

4. Asset Management. Dollies, tote boxes and roll cages are valuable assets themselves. This system provided greater visibility into their whereabouts,

pinpointing blockages and loss points. This tracking capability improved asset utilization and reduced unnecessary capital expenditures.

5. Transport efficiencies. Automated tracking of vehicles not only generated a security benefit, but also improved vehicle routing, driver performance and training, and vehicle availability.

6. Identification of future RFID applications. By involving warehouse workers and drivers early in the pilot, the employees quickly felt ownership of the system and incorporated it into their everyday operations. Their excitement about the project led to many other suggested applications of RFID.

Developing a leading RFID application provided Woolworths with a platform from which it could learn about its further application, develop new processes and gather previously unavailable information about its inventory and its movements, its processes and its assets. Woolworths recognized that no single initiative would provide a complete solution to eliminate shrinkage. This project did provide clear visibility to one area of potential shrinkage (the supply chain), reduced the opportunity for loss, and brought significant operational efficiencies. In conjunction with other initiatives, O'Neill felt that the RFID pilot produced significant reductions in shrinkage throughout the supply chain. It was, however, difficult to attribute quantifiable benefits to any individual component of the strategy.

The Future of RFID at Woolworths

O'Neill knew that Woolworths' initial success with RFID was no guarantee of future funding. He also knew that he could not look to the government to further subsidize RFID initiatives. The future of RFID at Woolworths now depended on a strong business case – one that could stand up against other requests for investment. With the Kingfisher divestiture, Woolworths had gone from a company with a net income of £800 million to a net income of £25 million, and as a result, an investment of £3 million would be scrutinized. Given this environment, O'Neill was forced to compete for scarce funding resources in a company that traditionally viewed new store construction as the surest way to growth. O'Neill would have to demonstrate that the £2-3 million earmarked for a typical new store would be better spent on infrastructure upgrades with a much more attractive ROI.[4] Clearly, senior management would only fund the projects with the best return for shareholders.

Given the initial success, O'Neill believed that a return on investment of less than one year was a realistic objective for a full-scale implementation. But he knew he had to be clear on where the savings would come from.

O'Neill reviewed his list of benefits from is pilot project proposal and started jotting down analysis notes under each category:

- ***Reduced Supply Chain Theft/Loss***. The "Russian Doll" concept maintained a detailed audit trail of the merchandise as it moved through the supply chain and

[4] A new store would typically achieve its ROI within the 18-24 months of operation.

assigned inventory accountability to each participant (i.e., loading dock employee, delivery driver, receivables clerk). This accountability should not only serve as a deterrent, but also provide important evidence for any criminal investigation.

- ***Improved Vehicle Utilization***. A recent piece of British legislation would require all commercial carriers to install electronic recording systems in their vehicles to ensure driver compliance with regulations governing daily driving time. This new Working Time Directive was scheduled to go into effect in April 2005. O'Neill viewed this requirement as an opportunity to enhance the required functionality with a GPS-enabled vehicle telemetric program. A Vehicle Telemetrics System would track and measure fuel economy, brake usage, and vehicle abuse in real-time. Preventive maintenance and measures (driving skills courses, driver evaluations, etc.) would be implemented to prolong vehicle lives and reduce vehicle downtime. Some estimates showed that transportation costs could be reduced by 8-10% using the smart system. The smart truck could be outfitted with a single black box that handled everything needed for RFID, telemetrics, and the Working Time Directive. Woolworths outsourced all of its transportation needs to one strategic partner. O'Neill argued that there would be ways to share the investment and the potential savings on the nearly £100,000,000 freight budget.

- ***Improved Asset Utilization***. Both roll cages and dollies were expensive distribution assets, costing £100 and £40 respectively. Woolworths had approximately 100,000 roll cages throughout its distribution system. Individual stores sometimes hoarded extra roll cages as a safety stock or for other tasks throughout the store. Often the cages were simply forgotten, misplaced, or stolen. Each year, central logistics planners were forced to buy additional roll cages to prepare for the holiday season rush. Better asset tracking would allow planners to recall outstanding assets or chargeback any lost roll cages directly against the individual stores. O'Neill estimated that at least 2,500 cages could be saved each year.

- ***Reduced Paperwork***. The electronic tracking and signature system would eliminate the need for paper-based manifests and proof of receipt documents. O'Neill estimated that the savings in the paper forms purchased and staff reductions at £350,000 per year. This did not include the expected savings from resolving errors with manual data entry.

- ***Inventory and Availability***. An additional area of potential savings that was difficult to quantify was the impact on inventory and availability. Inventory levels followed seasonal cycles, typically rising in the late summer and fall in preparation for Christmas. O'Neil estimated the Woolworths achieved about 4.5 turns/year. Inventory was also linked to item availability in the store. With a more accurate stock count, availability could be improved or safety stock lowered or both. Retail studies had shown that a 1% increase in availability could translate into .25-.5% increase in sales.

O'Neill estimated the cost of the full deployment to be about £2-3 million, including:

- £1,000,000 for system hardware, including tags for all 100,000 roll cages, readers for the other three distribution centers, and the additional portable units for delivery drivers. O'Neill felt confident that the tag cost would drop from the £8 they paid for the pilot units to under £5. That would leave £500,000 to purchase 100 dispatch bay readers, the necessary signposts, and the handheld devices for the trucks.
- £400,000 for software integration. O'Neill believed that the majority of software capability and compatibility was built into the pilot system, and therefore only minimal efforts would be required to extend the capability to incorporate roll cages.
- £1,000,000 for the vehicle telemetric system. This was the cost of enhancing the mandatory delivery truck system with GPS-enabled vehicle performance monitoring and reporting capability.

O'Neill realized that even if he successfully made a compelling business case, the tight overall information technology budget could cause any earmarked funds to be diverted should a critical IT system fail or collapse. Yet, O'Neill still felt hopeful that his project would be funded and 2004 would bring further supply chain breakthroughs for Woolworths.

Exhibit 1a: Woolworths Income Statement

(GBP Millions)	52 Weeks Ending 01-Feb-2003	52 Weeks Ending 02-Feb-2002	53 Weeks Ending 03-Feb-2001
Revenue	2,717.40	2,599.30	2,525.00
Total Revenue	**2,717.40**	**2,599.30**	**2,525.00**
Cost of Revenue, Total	1,943.10	1,850.30	1,763.80
Gross Profit	**774.3**	**749**	**761.2**
Selling/General/Admin. Expenses, Total	722.6	722	678.1
Interest/Investment Income, Operating	1.6	-3.1	0
Interest Expense (Income), Net Operating	**1.6**	**-3.1**	**0**
Restructuring Charge	5.5	12.1	0
Other Unusual Expense (Income)	6.3	60	24.3
Unusual Expense (Income)	**11.8**	**72.1**	**24.3**
Other, Net	-10.3	-9.5	-10.1
Other Operating Expenses, Total	**-10.3**	**-9.5**	**-10.1**
Total Operating Expense	**2,668.80**	**2,631.80**	**2,456.10**
Operating Income	**48.6**	**-32.5**	**68.9**
Interest/Investment Income, Non-Operating	2	2.9	2.2
Interest Income (Expense), Net Non-Operating	-10.6	-13.9	-14.6
Income Before Tax	**38**	**-46.4**	**54.3**
Income Tax - Total	**12.7**	**1.5**	**13.8**
Income After Tax	**25.3**	**-47.9**	**40.5**
Minority Interest	-0.1	0.7	0
Net Income Before Extra. Items	25.2	-47.2	40.5
Net Income	**25.2**	**-47.2**	**40.5**

Exhibit 1b: Woolworths Balance Sheet

(GBP Millions)	01-Feb-2003	02-Feb-2002	03-Feb-2001
Cash and Short Term Investments	133.8	129.1	0
Total Receivables, Net	128.5	86.1	2,507.10
Total Inventory	348.8	311.2	401.7
Other Current Assets, Total	0	4.8	0.5
Total Current Assets	**637.6**	**563.1**	**2,926.10**
Land/Improvements	11.5	12.8	12.8
Machinery/Equipment	717.6	677.1	616.5
Property/Plant/Equipment - Gross	729.1	689.9	629.3
Accumulated Depreciation	-396.5	-344.4	-291.3
Property/Plant/Equip., Net	**332.6**	**345.5**	**338**
Goodwill, Net	49	50.2	72
Intangibles, Net	14.7	18.2	17.5
Long Term Investments	0.2	0.1	0
Other Long Term Assets, Total	**4.2**	**2.3**	**0**
Total Assets	**1,038.30**	**979.4**	**3,353.60**
Accounts Payable	212.4	169.4	132.6
Accrued Expenses	65.4	64.2	82.2
Other Current Liabilities	199.3	194.4	388.3
Total Current Liabilities	**477.7**	**428.5**	**605.8**
Total Long Term Debt	**98**	**97.5**	**0**
Total Debt	**98.6**	**98**	**2.7**
Deferred Income Tax & Other Liabilities	27.3	26.2	26.6
Total Liabilities	**603.3**	**551.2**	**632.3**
Common Stock	176	175.9	175.9
Additional Paid-In Capital	0.2	0	NA
Retained Earnings (Accum. Deficit)	258.8	252.3	2,545.40
Total Equity	**435**	**428.2**	**2,721.30**
Total Liabilities & Shareholders' Equity	**1,038.30**	**979.4**	**3,353.60**

Exhibit 2: Map of the Woolworths Distribution System

Legend

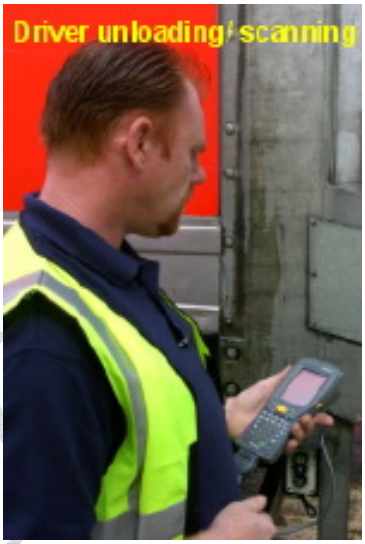
1. **Chester DC (seasonal merchandise)**
2. **Rugby DC (seasonal merchandise)**
3. **Castleton DC (general merchandise)**
4. **Swindon DC (general merchandise)**

Exhibit 3: Dollies and Roll Cages

Exhibit 4: The Solution in Action

Automated Storage and Retrieval System

Driver Unloading



Pick to Light System

Dolly with RFID Tag

The POD

Exhibit 5: Loading Dock

Exhibit 6: Technology Specifications

Savi Software products

- Savi Asset Management System—a full-featured, web-based software application for managing the complete life-cycle of critical supply chain assets such as dollies, totes, trailers, intermediate bulk containers, pallets and other types of high value mobile assets.
- Savi SmartChainTM Platform—SmartChain is a distributed logistics platform that collects, aggregates and processes data in real-time.
- Savi Site Manager—The data is sent to SmartChain from the Savi Readers via the Savi Site Manager. Site Manager provides a local point of presence for data collection.

Savi Hardware Products

- Savi SR-600 Readers—Savi's fixed Readers were placed at Woolworths stores to monitor tag activity and communicate tag location and data to the Savi SmartChain platform.
- Savi SP-600 Signposts—A total of thirty Savi Signposts were placed a various distribution centers. Signposts activate tags within their vicinity for enabling precise identification of tagged items at specific locations.
- Savi ST-602 Tags—A total of 15,200 Savi Tags were placed on Woolworths, Plc. containers. The ST-602 tags are small (6.2 cm x 4.3 cm x 1.2 cm), and mountable with dual short range and long range frequency transmission.
- Savi SMR-640P Mobile Readers—A total of fifteen Savi Mobile Readers - mobile, lightweight, battery operated reader modules used with an off-the-shelf Personal Digital Assistant (PDA) to commission, identify and configure the Savi Tags – were used by Woolworths personnel.

The Savi Series 600 components (Readers, Tags, and Signposts) were built on Savi's innovative EchoPointTM technology. Savi's EchoPoint technology used two operating frequencies. EchoPoint combined long-range communication (at 433.92 MHz) with precise spot-level locating (at 123 kHz and 132 kHz).