

RFID Demystified: Part 2 Applications within the supply chain.

By

Dr Richard Wilding & Tiago Delgado

**Centre for Logistics and Supply Chain Management, Cranfield School of
Management.**

Introduction

In our previous article we discussed the technology, benefits and barriers to implementations of Radio Frequency Identification (RFID). In this article we discuss where this technology can be applied.

Essentially, it is argued that RFID systems help companies to cut costs, improve customer service, reduce labour, increase accuracy and improve supply chain throughput. RFID systems applications can be used by different industry sectors like the military, retail, industrial, life sciences, logistics, and financial. The military and the life sciences sectors have been the first in using this technology (Das *et al*, 2002; Harrop *et al*, 2003; IDTechEx Ltd, 2003a), although within a more expensive and sophisticated context than we may find in most consumer goods supply chains. Surveys of the application of RFID technology find it is being used mostly for industrial/manufacturing - 44.5 percent of the RFID market (Perez, 2003) - and transportation/distribution - 30.3 percent of the RFID market (Perez, 2003).

However, the retailing sectors currently only account for 4.3 percent of the RFID market (Perez, 2003) but it is forecast that substantial growth will occur in this sector. In the last few years retailing has been relying mainly in a large-scale use of Electronic Article Surveillance (EAS) systems. EAS tags are commonly

attached to items to protect from theft. Additionally some applications may be used across industry sectors like the retail and industrial sector for cross-industry logistics functions.

RFID systems should not be seen as a substitute for other identification systems like barcodes. Their multifunctional capability can provide additional features that allow the use of this technology for other applications that consequently add value. RFID can be used to address the following important issues within a variety of business sectors:

- Asset/product Tracking
- Product Handshaking
- Anti-counterfeiting
- Safety and Security
- Access Control
- Condition monitoring
- Transactions
- Positioning/Locating
- Real time theft detection -Shrinkage
- Real time tampering detection
- Market research
- Entertainment
- eCommerce fulfilment
- Controlling grey markets
- Industrial and Warehousing
- Merchandising

We will proceed to discuss the main applications but it will be seen that many of the above are interrelated. The discussion will focus on the most relevant applications within logistics and supply chain management.

Asset and product tracking

Milner (2000, p.14) provides a clear definition of the use of low cost RFID technology for asset and product tracking. He says it “*can be used to monitor and manage the physical movement of materials and finished products, to generate and deliver a flow of critical information, and to form the basis for enhanced working between supply chain partners*”. This application is of particular interest for the supply chain management in warehousing and distribution, as these activities, accordingly to MIT (Harrop *et al*, 2003), account for 75 percent of a retail product cost. Tracking items like assets or products allows knowledge to be gained on the history of the item and the process it has been through (Graham,

2003). This capability enhances the control of operations by reducing stock losses and improving the supply chain visibility.

The use of this technology for asset tracking is mainly used for vehicles and containers tracking (e.g. fleet management, military logistics, postal services, food and clothing retail) where the tags cost is very small comparing to the tagged asset value. The use of RFID technology on an item level is still restricted by the tags cost and other problems regarding physical features, e.g. size; metallic and electric interferences (Finkenzeller, 2003).

Product handshaking

Product handshaking is concerned with the guarantee of the correct association between products/parts by auto-rejecting un-authenticated products/parts (Das *et al*, 2002). Therefore, by using RFID tags, counterfeited or wrong products/parts will not be able to be used even if they are the exact copy of the genuine product/part. The product handshaking feature can be used for safety reasons, assuring that sensitive parts are correctly assembled, avoiding the costs associated with serious consequences or product recall, e.g. pharmaceutical industry.

This feature can also be used as an anti-counterfeiting measure, and as a result, products like printers can be prepared to only operate when using the correct cartridge, ensuring that companies will be unaffected by sales reductions on products' accessories.

Anti-counterfeiting

The anti-counterfeiting function of RFID technology is normally associated as an additional feature provided by RFID chip-based tags and is partly addressed in the asset and product tracking and product handshaking functions. However, counterfeiting is a major concern for all industries and some companies are just looking for this type of functionality from RFID technology.

Safety and security functions

Electronic Article Surveillance (EAS) has been used extensively by the retail industry, and although it is not an RFID technology, this feature can be easily included in the functionality of RFID tags. Furthermore, the safety and security functions of RFID technology are partly addressed in the access control, product handshaking and product/asset tracking functions. In addition to item or person identity confirmation it is possible to use RFID technology for tamper detection in packages (e.g. medical products) or documents (e.g. detection of rewritten cheques). Finally, a common place use of RFID technology for security purposes is the cars ignition systems, which are equipped with a reader and will only start the engine if the RFID tag inserted in the car key is recognised, this is also forming part of the keyless ignition systems found on many vehicles where the vehicle senses the RFID tag and opens the doors of the vehicle.

Access Control

RFID systems can be used to verify automatically the access status of individuals to premises in what it can be considered a security feature. This feature is already being used with other systems that require the direct contact between a transponder and a reader (e.g. magnetic stripe cards, contact smart cards incorporating a chip) or infrared scan of barcode cards. The advantage of RFID systems in this case is the opportunity of having a contactless access system that only requires a minimum reading range without having to be in line of sight (Finkenzeller, 2003). This allows faster and accurate rates of access with reduced maintenance cost because the readers can be protected from environmental conditions and vandalism.

Condition Monitoring

RFID tags with sensor functions can monitor physical conditions, like temperature, humidity, or if the product suffered any knocks. This feature is being used by the United States Military (IDTechEx Ltd, 2003a) to monitor the condition of munitions but it may be used in the food retailing industry where the chill products condition can be continuously measured. If some condition is altered the system can flag up a warning or set off a corrective procedure. Condition monitoring can be also used for anti-tampering purposes, detecting changes in some physical conditions of the product (IDTechEx Ltd, 2003b) or detecting if the tag is being peeled off (Harrop *et al*, 2003). This type of application is also being used in “cold chain” applications within the pharmaceutical/health industry to detect if products, have been subjected, during transit, to temperatures outside tolerance limits set by the authorities.

Transactions support

RFID technology also provides the capability to handle financial transactions with the same security provided by the common contact smart cards but also having the benefit of being contactless (Finkenzeller, 2003; Das *et al*, 2002). This it is argued is more convenient to both companies and consumers. Working towards this application development, Texas Instruments announced in February 2003 a proximity payment transaction platform that allows financial transactions with greater security and higher data rates (Murray, 2003). The advantages it is argued will be a reduction of queues to pay, a reduction of costs associated with payment cards because RFID cards will last longer and can be reused unlike traditional magnetic strip cards that wear out. Also greater functionality could be included in the card. An example of the application of this technology can be seen in the road tolls payment systems where vehicles tags are identified by reader at the tolls' entrance and exit and fares are automatically calculated and

debited on tag owner bank account – e.g. Via Verde-Portuguese tolls-fees' transactions¹.

Positioning/locating functions

The real time information about the position or location of something (e.g. animals, stolen goods, persons, freight) is an important application for RFID technology. However, at the present moment, for the majority of applications, this will require expensive RFID hardware as it is necessary to have higher levels of range. This function informs where something with a RFID tag is located, either because it passed an interrogator or an interrogator is detecting it.

RFID systems used in these types of applications are limited to restricted areas, for example warehouse yard management. Presently, GPS systems have more success in this field.

Merchandising support functions

The implementation of RFID technology focusing on merchandising functions is already being tested. One example that clearly illustrates it is the trial being conducted in an Extra store in Rheinberg, Germany - The Metro Future Store² (Benoit, 2003). One of the applications for RFID tags is being tested in "Pantene" shampoo bottles to achieve a more direct communication with the customer. When a tagged shampoo bottle is lifted from the shelf, it activates the display screen above the shelf starting a commercial advert or communication tailored to that product.

Nevertheless the use of RFID technology for marketing functions will be mostly dependent of item level tagging and at the present this is still not feasible in the short term within the FMCG retail industry. Few organisations are doing this as

¹ For further details on this system see http://www.viaverde.pt/vv_ct_01.asp?id=7&idioma=3

² Information on this project can be accessed in the internet address <http://www.future-store.org>

yet. However Prada (the fashion retailer) has applied it to high value product at the Prada store in New York.

Other possible uses could be monitoring customer behaviour by using RFID loyalty cards and providing tailored marketing approaches accordingly to customers' shopping habits (Harrop, 2000).

Industrial and Warehousing

The use of RFID technology has many applications in the industrial and warehousing environment. Many of those as product handshaking, near real time inventory control, or condition monitoring have already been discussed. Additional applications for RFID technology can be found in these areas. Warehouse picking can be made accurately and automatically (Graham, 2003), and warehouses' yard management can be optimised so that vehicles and cargos can be identified as they enter a compound and are directed to the right location to be unloaded or loaded. An other example is the application in RFID to conveyor picking systems that results in increased efficiency due to the higher levels of accuracy performed by RFID systems.

Multi-functionality

RFID technology offers the opportunity to integrate different applications under the same system, which will lead to cost savings and improved customer service.

In Asia, transport contactless smart cards can be used to buy items from vending machines and shops (Finkenzeller, 2003). In the retail environment, RFID smart cards used for payments may also be used as loyalty cards and having other value-adding services.

Conclusion

Table 1 summarises the Applications that are possible with this technology as advocated by various commentators on the subject. There is little doubt that RFID will find applications in a variety of environments and will have a significant impact on supply chain performance.

In our final part of RFID Demystified. We will proceed to discuss the actual cases where the technology has been applied.

Application Areas	Applications	Authors							
		Milner (2000)	Harrop <i>et al</i> (2003)	Graham (2003)	Finkenzeller (2003)	Das <i>et al</i> (2002)	Beck (2002a)	Murray (2003)	Overby (2002)
Asset tracking and management	Monitor/manage movement of goods	✓	✓	✓	✓				✓
	Locating products	✓	✓		✓				
	Position of assets	✓	✓		✓				
	Optimized warehouse yard management			✓					
Increased security of goods	Anti counterfeiting features		✓		✓	✓			
	Product hand shaking		✓			✓			
	Prevention of internal and external theft						✓		✓
Improved Stock Management & Availability	Picking error detection		✓	✓	✓	✓			
	Condition/environment monitoring		✓		✓	✓			
	On-shelf availability		✓		✓	✓	✓		
Reduced errors in product/data handling	Reduced checking		✓		✓	✓			✓
	Reduced inventory counting		✓			✓			
	Improved inventory accuracy	✓	✓		✓	✓			✓
Customer focus applications	Transactions support		✓		✓	✓		✓	✓
	Increased interaction with customers		✓		✓				✓
	Improved customer monitoring tools		✓						✓
	Multi-functions integration application		✓		✓	✓			

Table 1: RFID Applications per Application Area as referred by some authors

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