

Critically evaluate based on a case study the application of technology to support innovation for competitive advantage in global logistics

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Abstract

In this report, we will discuss the subject of RFID technology in order to study using a practical case the competitive advantages of its use in the supply chain. At first, we will treat the RFID technology by detailing its operation then we will study the case of the Spanish company ZARA, world leader in the sale of clothing textile, which uses this technology at each stage of its supply chain.

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Introduction

« Almost all quality improvement comes via simplification of design, manufacturing, layout, processes, and procedures » - Tom Peters

In recent years, the rapid evolution of technologies associated with a sharp decline in costs, industries have not stopped to invest in their developments. Some choice of necessary to stay competitive in a sector more competitor, with the respect of the expectations of the customers. This quote from Tom Peters is increasingly true, companies want to automate and simplify their processes to save time and money without reducing the quality of their products or services.

It is in this environment that they emerge from Industry 4.0. It is a cross between physical and virtual activities, an interconnectivity between these two worlds.

Intelligent identification, using RFID tags, is one of the parts that make up this new vision of the industry, called the Internet of Things. Indeed, this tool makes it possible to effectively monitor products and to record data that could be used by all the players in this industry.

We will therefore discuss the subject of the contribution of technologies, which provide a real competitive advantage in global logistics, using RFID technology and studying the case of the company Zara.

1 RFID Technology

1.1 Definition

RFID, for Radio Frequency Identification, is a wireless communication technology used to uniquely identify objects. Working through tags and readers, it is possible to read and write information at a distance using electromagnetic waves.

1.2 Composition

1.2.1 RFID tag

Composed of a semiconductor antenna and sometimes a battery, it can be encapsulated, packaged or glued on products. Serving mainly for identification, the tag is injected information in the form of a computer code within its chip. The format of this data meets the standardization EPC (Electronic Product Code). This is a syntax for identifiable entities that play a role in business operations.

The first function of an RFID tag is the storage of information in the form of a code in order to transmit it to the transmitter of an interrogating signal. This chip is composed of a memory that can store the code and sometimes a battery to activate the chip. This differentiation allows the emergence of three different types of passive, semi-passive and active tag.

Tag	Passive	Semi passive	Active
Energy	Electromagnetic signals	Interval activation battery	Constantly activated
Storage capacity	Low	High	Higher
Speed	Low	High	Higher
Reading distance	Short distance (2 feet)	Between 2 and 60 feet	Long distance (60 feet)
Example of use	Identification card	Temperature sensor	Inventory
Price	Low	High	Higher
Lifetime	Long life expectancy	Shorter	Short (7 to 10 years)

Figure 1: Table presenting the different types of tags

1.2.2 The reader

Composed of an antenna and a circuit emitting electromagnetic energy, it makes it possible to request access to the RFID tag data. If the exchange works, the reader will be able to decipher the contents of the information stored by the transponder. In addition to having the ability to read the content of tags, it is possible, to a certain extent, to transmit and write content on the tag's chips. It is also the reader that will serve as an interface by transmitting information from the RFID chip to the company's system, the middleware.

1.2.3 Middleware

Middleware is software that allows data to be exchanged between a company's information system and the raw data collected by RFID readers. It allows to collect, filter and integrate data in business software.

1.3 System operation

1.3.1 Communication



Figure 2: Operating diagram of RFID technology

RFID technology works by using electromagnetic waves. Working through a tag, a reader and an interface, it allows the writing and reading of information. The tag and the reader communicate with each other by sending waves. When a tag enters the wave transmission field of the reader, it activates and transmits its data. After receiving them, the reader transfers the data to the middleware which is responsible for transforming them into actionable information for the business software.

1.3.1.1 Different communications

1.3.1.1.1 Read only

The tag is only readable. That is, the manufacturer has written information about the tag and that tag is not editable. In the case where a user buys a blank tag and inscribed by itself an information it is a WORM (Write Once, Read Multiple). It can be used, for example, on clothing sold in stores. This makes it possible to detect the theft of merchandise.

1.3.1.1.2 Multiple readings and writings

The tag can be read and rewritten. This allows the update of the information. There are two types of tags in this category. Those that are readable and re-writable without restriction, which are especially used in livestock, to ensure a monitoring of animals. They are called R / W for Read and Write. There is also MTP mode for Multiple Time Programmable. In this situation, some memory zones can only be reprogrammed a specified number of times.

1.3.1.1.3 Protected readings and writings

In this case, the data from one or both of these processes is protected by a password using software. They may also require specific hardware to read the data. There is also an encrypted version of this system to prevent clandestine interference with reading or writing data. This is done through a code that can only be read by the sender and receiver with the decryption key.

1.3.2 Advantages and disadvantages

Although widespread in the industry, RFID competes with other technologies. We will list the advantages and limitations of this technology while sometimes comparing it with the barcode.

1.3.2.1 Advantages

1.3.2.1.1 Storage capacity

The first advantage of RFID technology is its storage capacity. Indeed, it is possible to store up to 128Kb of data on the chip. It is therefore possible to store more than 10,000 characters. It is also possible to use tags with smaller memories if the information does not require such a large storage capacity. In contrast, barcodes do not allow to store as much character. Indeed, the barcode that has the largest storage capacity, 2,000 ASCII characters, is called DATA MATRIX Bar Code Symbol.

1.3.2.1.2 Traceability

This technology meets a standardized coding system allows to establish a secure traceability. Indeed, according to the chips, it is possible for the readers to write information on the chips. If this writing system is used at all stages of the supply chain, all actors in this chain are able to know the different steps followed by the product associated with the chip. This allows a follow-up, a security of the information as well as its immediate availability.

1.3.2.1.3 Security

The chip being in the form of an electronic medium, it is possible to secure it. Indeed, a bar code can be accessible to everyone and it is possible to scan or take a picture to decipher it. While it is possible to block attempts to steal data by protecting the chip by asking it to refuse unauthorized connections. It is also possible to encrypt the data so that only a reader with an encryption key can read them.

The complexity of the RFID chip makes the cloning of data diffuse. It is therefore deified to change the prices of items that can be stored in chips, or to duplicate an access card. Unlike a simple photo replicates a barcode.

1.3.2.1.4 Reusing

Unlike the bar code, it is possible, if the chip allows, to rewrite its content. This makes it possible to modify the information contained therein or to allocate the chip to another medium. The barcode, meanwhile, cannot be modified when it is printed.

1.3.2.1.5 Detectability

The barcode needs to be visible to be read by a reader. The latter is responsible for identifying the code using the bars that compose it. The chip when it does not need to be visible. Indeed, the system operating using electromagnetic waves it is possible to read the chip remotely, with a greater or lesser distance depending on the quality of the equipment. In addition, the technology operating without contact it is possible to control and identify all the products present on a logistics unit if each package contains an RFID chip since the reader can identify several.

In addition to the identification, it also allows to change the chips at once with a simple signal. In the case of a bar code, it is necessary to print and then glue on the logistics unit.

1.3.2.1.6 Resistance

Labels, which do not need to be outside the packaging, are less sensitive to environmental conditions. Indeed, when logistics units integrate the supply chain, the goods are brought to be moved in under climatic conditions or in places that can alter the packaging and therefore the bar codes. The chip when it remains protected since it does not need to be visible.

Indeed, it avoids a loss of time, because when a barcode is damaged, it is sometimes necessary to have to scan several times or have to enter manually.

1.3.2.2 Limits

1.3.2.2.1 Cost

Sold at a high price during their democratization, the RFID chips saw their price considerably decrease. Indeed, today the price of a tag without installation oscillating between 5 to 10 cents of euro when an anti-theft label costs EAS 3 centimes and a bar code costs only the price of a printer and its ink, either less than 1 euro cents per code. The price of a tag being higher at the installation, it remains a smart investment if the companies decide to use them in cooperation with their information systems.

1.3.2.2.2 Environment of use

Operating using electromagnetic waves, RFID technology is sensitive to metals. Indeed, during their presence, the waves can be disturbed and therefore not be as effective as they should. It is therefore necessary to seek solutions so as not to risk any errors.

This is particularly the case with the principle of the Faraday cage which creates an electromagnetic shield. It is possible to observe phenomenon when placing a tag in a metal box. The reader and the tag are no longer able to communicate together.

Nevertheless, today new tags are designed to reduce the impact of the presence of metal objects in order to maintain a communication distance close to normal, with the exception of the Faraday cage.

1.3.2.2.3 Interference

It is possible to witness a collision phenomenon. This phenomenon appears when several tags are located in the field of the same reader. In fact, communications will be blurred between them.

However, there are solutions to avoid these errors:

- Frequency method: The tags use different communication frequencies with the reader. However, this technique can only be used on a small scale.
- The spatial method: This method, used when the markers are scattered, allows readers to query the tags separately by targeting different spaces one after the other.
- Temporal method: This method which allows an identification of different markers present within the same zone, works on a system of temporality. The reader sends queries to the markers with the possibility of returning a signal in a time channel. This avoids receiving all information at the same time. When multiple markers respond at the same time, the reader returns a query until each marker responds separately.

1.3.2.2.4 Health Impacts

In recent years, the issue of devices emitting waves make a lot of talk about them for their impact on health. This is particularly the case of mobile phones. RFID technology is also affected by these debates. Passive tags, however, are not concerned since they only emit waves after a first interrogation by a reader. This subject is mainly focused on the regulation of the transmit power of readers in order to avoid disturbing medical equipment and human organisms.

2 The case of ZARA

After introducing the RFID Technology, we then study its effects within the company Zara who has invested heavily in this technology.

2.1 Company presentation

Zara, a brand belonging to the Inditex Group, is the leader in the sale of clothing for people of all ages. It was founded in 1975 by Amancio Ortega Gaona. In 2018, the company achieved a net profit of 3.44 billion euros in 2018. This sales and financial force allow the brand to invest in the development of my online sales as well as in the use of technology. RFID, and that since 2013.

2.2 Use of RFID

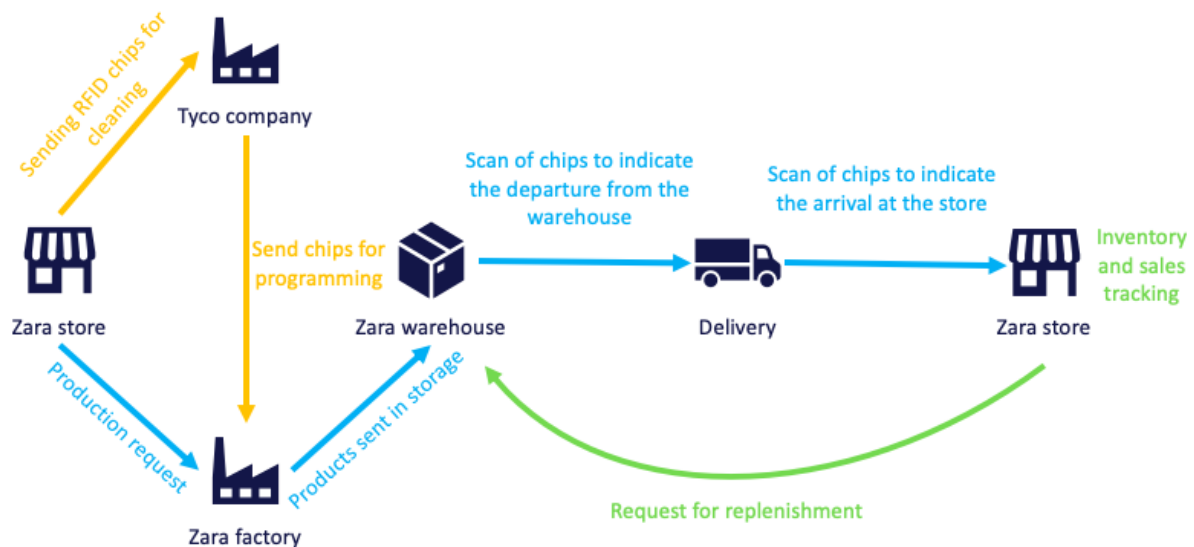


Figure 3: Diagram of the functioning of the supply chain of the company Zara

Zara's supply chain, which is quite different in terms of technology than other brands in the group, is particularly innovative while using RFID technology. Indeed, unlike some companies that will use it at certain stages of their chain, Zara uses it at all stages. It takes first form when selling products through the connectivity of the internal system of the company. The data collected makes

it possible to start production and then temporarily store the goods. Then finally the stores are delivered automatically thanks to the information system.

2.2.1 Sale in store

Each product in Zara stores has a unique RFID tag with product information such as model, size and color. These tags allow in a first to avoid theft. Indeed, stores are equipped with security gates that activate when the RFID chip enters their electromagnetic field.

The information contained in the chip, allows the company's information system to establish statistics and produce market research. That is, that the company evaluates the sales of their products directly. She knows if it is necessary to restart a production or not. It is also possible for Zara to establish a profile for each of their clients by grouping together data such as age, place of residence and list of their purchases.

When selling a product, the RFID chip is dissociated from the product for later use on a new item.

2.2.2 Production

The principle of this collection of data is the automatic launch of production. In fact, Zara uses a data crossing technique to produce a sales forecast and therefore a production forecast. Although performed automatically, company employees check the numbers to regulate the numbers based on the forecasts of the new collections.

When stores sell products, an automatic inventory report is made to forecast sales. Production is then started accordingly.

Once produced, the goods are associated with an RFID chip containing their information, which enables automation and control throughout the supply chain. This chip comes from a previous article, so it is erased and rewritten. This allows not to waste chips, which represents an important step towards sustainable logistics given the number of sales made.

2.2.3 Storage

The Zara system works on a principle approaching just in time, that is to say that the company manages very little stock of goods, the production being carried out in real time. The goods are then stored in a warehouse for a short time before being delivered to the stores.

After being ordered by the information system, the goods are packaged and prepared for loading into vehicles for deliveries. From this point on, product tags are read to signify to the information system, that the products have left the warehouse towards the store. This will alert the store to prepare for the reception.

2.2.4 Delivery

When the goods are delivered to the warehouse, it is necessary for the employees to check the goods in order to be sure that the order generated by the system corresponds to the order received. Thanks to RFID technology it is no longer necessary to check each article or cardboard individually. Indeed, it is possible, with the aid of a simple reader to control the presence of all the items ordered thanks to the chips that own each clothes.

The same operating principle is applied during inventories. At the front the employees had to control the quantity of all items present in the shelves as well as in the stock individually. Thanks to this technology it is possible to perform a complete scan of the magazine using a reader. Following this it is sufficient to control the quality read to that recorded by the inventory information system. In the case the states of a reference do not correspond, it would be enough to check, manually, only the products of the reference concerned. The time saving is around 80 percent.

2.2.5 Possible evolution

It is possible to see the future of the business in two ways. At first it should be noted that Zara belongs to the group Inditex, but as specified by its director, the brand is ten years ahead of the other brands belonging to the group. It is therefore a first step to put all these marks on an equal footing.

Despite the lack of communication on the part of the brand on its future evolution in the supply chain, it is possible to imagine future developments.

Indeed, it is possible to imagine that the company makes available the quantity of products remaining in a store on the website of the brand. This allows customers to know if the product they want is always available. This feature is possible thanks to RFID technology since the information system of the company knows at any moment the number of products present in the various stores thanks to the scans of the chips at the arrival and the exit of the articles.

3. Conclusion

It is interesting to note that a technology used during the Second World War to differentiate allied and enemy aircraft was taken over and its development continued to become a major element of traceability in industry. It is even possible to say that today this technology represents a masterpiece of industry 4.0. We have seen that, unquestionably, RFID allows companies to establish complete traceability of the products that exploit it. It also allows, along with sales forecasting software, to improve analyzes by adjusting production demands at any given time. Technology allows all stakeholders, who act within the supply chain, to record and consult the steps taken by the product associated with the chip.

Zara is one of the industries that has rapidly invested in this technology and has proved its effectiveness by dominating the clothing market. The case of Zara, like many companies, shows that it is important for business development to invest in the use of technology. The development of global logistics passes, today, by the adoption of industry 4.0.

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