The Peloton Approach: Forecasting and Strategic Planning for Emerging Technologies - A Case for RFID

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More than a thesis, for me, this has been a labor of love....I dedicate this thesis to my parents & to my two wonderful daughters, Anjinee and Arshia for their love and to my wife, Eela, for her unstinted support for my work at MIT even when she was going into the labor room when I was in an important phase in this project...without them, my stint at MIT and HBS, juggling around with work from all quarters would not have been so memorable....

I am indebted to Brian and Sanjay for being there for me, wherever in the world they were, responding to my emails even at ungodly hours.

The Peloton Approach:
Forecasting and Strategic Planning for Emerging Technologies
- A Case for RFID

The structure for the section on Gillette as a reference case for general management frameworks for strategic decision making around networked businesses was done with additional guidance from Prof. Thomas Eisenmann, as a part of the course "Managing Networked Businesses" that I took with him at the Harvard Business School in Spring 2006. My original paper that I submitted for his course, from where I have adapted this section, is being considered for publishing as an HBS case based teaching material.

The section on Peloton Forecasting, the heart of this thesis, has been short-listed first round by the International Institute of Forecasters for publishing in the International Journal of Forecasting and has been selected for presentation at the International Symposium on Forecasting at Santander, Spain – June 11-14, 2006.

Immediately after graduation on June 9, I leave for Spain...and life after MIT would not be the same with RFID around!

The Peloton Approach: Forecasting and Strategic Planning for Emerging Technologies - A Case for RFID

By
Vineet Thuvara

Submitted to the System Design and Management Program on May 12, 2006 in partial fulfillment of the requirements for the degree of

Master of Science in engineering and management

Abstract

The RFID industry is going through a sea of change and at different levels within the industry. Forecasts have been done on different facets of the RFID/EPC industry like the market size or the possible financial returns. However, the forecasts to date are not based on a collective view on the evolving, dynamic and inter-relating nature of such technology covering Retailers, Suppliers and Industry experts on the same landscape.

The EPC Peloton Forecasting and Strategic Planning Tool was developed out of a need to collaborate and form consensus around the events and milestones that are critical for the widespread adoption of EPC for the Fast Moving Consumer Goods ("FMCG") industry. Though developed around its need in the RFID space, this tool can be used for decision making around any emerging technology. We are at a critical juncture in the history of RFID where there is excitement among stakeholders and the technology's promise needs to be harnessed by providing the stakeholders with a clear idea of (a) where the technology's future lies and (b) how consensus on how to achieve such a future can be facilitated. The Peloton Approach deals with how to identify or develop a technology forecasting methodology that could capture inputs from all dimensions of the industry and lay down a range of possible future paths. To address the latter issue of collaboration, the Peloton aids in identifying the various stakeholders and their stages of adoption and provide a platform for people at a similar level of adoption to collaborate or enable those seeking information to be able to get into the bandwagon and adopt relevant strategies.

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What does the word Peloton mean? Why is it used here?

Traditionally used in cycling, a Peloton refers to a cluster of riders sheltering in each others' draft towards a common goal. By working together these riders can reach their goal faster than they could have on an individual basis. Peloton concepts can be applied to new technology and we use the concept to speed the adoption of EPC. By using the Peloton, companies across the EPC industry can benefit from each other's progress very much like competing cyclists benefit from each other in a Peloton.

Structure of this thesis

To substantiate the significance of the need for frameworks for general management and technological decision making in emerging technologies, where standards have not been set, forecasts are unknown, this thesis is presented in two sections.

Sections 2 & 3 are created to serve as a prologue to the real need for a Peloton. The first deals with the issues that top management at Gillette had to consider when making its landmark decision on the 500million RFID tags order with Alien Technologies. Here my attempt is to bring to light the myriad of uncertainties and choices that Gillette was faced with, primarily because it was so difficult to predict what the future of an emerging technology like RFID would be. In the latter part of the first section, we look at the impact of Gillette landmark decision and try to get some frameworks for general management food for thought. *(Since Sections 2 & 3 were developed in collaboration with Prof. Tom Eisenmann of Harvard Business School and that it is being considered for publishing as an HBS Academic Case, please seek explicit written permission from the author for reproduction of whole or any part of Section 2 and 3)*

Section 4 starts with the premise that forecasting for Emerging technologies is difficult; By breaking down the components of the technology into constituent parts and by scientifically developing an expertise and lead-user driven forecasting methodology, create a visual decision making tool for general managers to make decisions around the RFID space.

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Section 1

Introduction

The research that we intend to report in this paper is the result of collaboration between the MIT (Massachusetts Institute of Technology) Auto-ID labs and the RFID industry partners championed by EPC Global. As a starting point, we set two goals for such paper. The first one is to develop a novel forecasting methodology that can overcome some of the limitations of current judgmental approaches such as the Delphi method and the second one is to illustrate its validity in strategic planning in a specific domain: the RFID industry.

We believe our forecasting methodology borrows from existing judgmental approaches to situations in which there are many stakeholders whose future plans depend on the forecast itself. The research that led us to develop the Peloton Forecast methodology was inspired by two observations. The first observation is that complex industry transformations involve multiple simultaneous and interrelated changes. For example the evolution of the PC industry required ever larger hard discs. However, such larger hard discs were not possible if access technologies did not evolve concurrently. At the same time, faster access technologies may be unnecessary if there is no application such as the need for larger hard drives. In other words, advances in each of these two technologies has historically benefited from progress in the other technology. Companies in these two industries have benefited from progress in each other very much like competing cyclists benefit from each other in a Peloton. A Peloton is a densely packed group of riders, sheltering in each others' draft. Traditionally used in cycling, a Peloton refers to a cluster of riders working together towards a common goal, and can be analogized to the PC industry. In fact, the concurrent progress mentioned above has not been isolated to two technologies and has included many others such as: networking, interface technologies, operating systems etc. As a result of this collaboration, the group as a whole can travel faster than an individual cyclist (or company) could.

Similarly, the Peloton is not a panacea, but rather an enabler to industry collaboration. In order to get true value and industry alignment from the Peloton, it needs to be developed and updated by members of the EPC community. Later in this paper, we will propose how EPCglobal, as the Industry Standards Body, can play a critical role in collecting, summarizing and disseminating members' input to the EPC community at large. If properly developed and used, the Peloton can align the industry on critical events which need to occur in order to capture certain business benefits.

The RFID industry is facing similar collaboration challenges like the ones mentioned above. As an example, assume a FMCPG Supplier has estimated combined manufacturing and distribution center (DC) productivity or efficiency gains with EPC by conducting a series of time-and-motion studies. If the DC is managed by a third-party logistics ("3PL") provider, then the FMCPG Supplier must achieve alignment from the 3PL regarding the process changes, amount, level and timing of efficiency gains to be had from EPC. This will likely include sharing the results of the time-and-motion study and the 3PL's independent validation of the assumptions as well as collaborating in the implementation of the improvements. In addition, the 3PL contracts will require re-negotiation and amendment for these estimated productivity gains. This entire process could take several months to complete.

The companies could benefit from a forecast of the evolution of the industry as it affected all the players, not only the FMCPG Supplier and the 3PL but also hardware manufacturers (including tag and reader manufacturers), appliance manufacturers, software companies and others. With the information that such a forecast would provide, companies could direct resources to ensure that progress towards key milestones is taking place in a way consistent with the overall development of the industry.

The second observation is that, as will be shown in the Section 3, there is no known methodologies that can assist in coordinating such a large volume of actors concurrently plan an evolution path for their industry.

The development of what we call a Peloton forecasting methodology is spearheaded by the need mentioned above to forecast a new and rapidly growing industry: the RFID/EPC industry in the Fast-moving Consumer Products Goods Industry. The objective of the forecasting approach in the RFID/EPC domain is to attempt to facilitate the rapid adoption of RFID technology and also facilitate existing and prospective stakeholders plan their path for adoption of this new technology. The research conducted involves four rounds of surveys to about 50 key stakeholders ranging from suppliers to retailers and industry experts. The methodology developed in our research, when applied to the RFID industry, will produce a timed and structured forecast of how the industry will evolve. It will not only predict the timing (as the Delphi method would) but also the different steps expected of each player. Thus, it will help each industry actor plan its own activities in a way that is consistent with the overall forecasted evolution path for the industry. The forecasting methodology is designed to help the industry invent itself in a way that optimizes the use of resources so that both adoption time and unnecessary investments in R&D are minimized.

In the rest of this paper, we would review the RFID/EPC forecasting challenge in Section 4, and then review in the next Section the existing literature on judgmental forecasting techniques. A simple review of judgmental forecasting methods is included here. In Section 5, we would explain the Peloton Forecasting technique. In Section 6, we would analyze the results of applying such methodology to the RFID/EPC extended fast moving consumer products goods (FMCPG) industry.

However to lay the foundation for the need for forecasting in the area of emerging technologies, the next section begins with Gillette's decision point around ordering 500 million RFID tags to give a boost to the FMCG industry. In the next two sections, we reconstruct Gillette's decision from a general management point of view and then use some academic theories to arrive at some frameworks to understand networked businesses.

Section 2

Gillette's Landmark Decision and RFID Industry[1]

Reconstructing Gillette's Decision point in 2002: Order 500 million tags?

"We see RFID as the supply chain technology of the future. It's going to revolutionize the way we track goods from manufacturing to the consumer and even through recycling."

Dick Cantwell,
Vice president of global business management
The Gillette Company, April 12, 2002: CIO Insight magazine[i]

For the last several weeks, Dick Cantwell, Gillette's VP of Global Business Management a, proponent of the RFID movement had been preparing for the MIT headquartered Auto-ID Center's board meeting which was on November 14, 2002. He knew that Gillette had a very strong reason to invest in RFID (Radio Frequency Identification) but he also knew that the RFID industry was in a very nascent stage of development and adoption, the tag costs were high, there was no widely accepted standards as such, the barcode had its legacy, and like the "lemmings" each company that saw long term value in RFID waited for the other to make the "leap of faith".

Cantwell believed that 500 million tags would be a tipping point for widespread adoption of RFID and for tag costs to go below the 10c mark....and Alien Technologies (a Morgan Hill, California start-up), with their proprietary Fluidic Self Assembly (FSA ®) production technology will be able to deliver the tags in that quantity and price. RFID was slated to transform the supply chain landscape and the first-mover possibly had a great advantage of

[1] This is adapted from the draft stage of an HBS case 'Gillette – Racing on the RFID wave for FMCG' by Vineet Thuvara for a course by Prof. Thomas Eisenmann of the Harvard Business School. For reproductions in part or whole of this particular section, explicit written permission may be required from HBS and MIT. The construct of this decision point is developed solely as the basis for class discussion and are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management.

building a faster network of RFID infrastructure and reap the benefits early on. But as of now, the tag costs were high, readers had to be installed which posed a "chicken and egg" problem and above all standards had to be ratified.

Two days before the board meeting, quite late in the night, on the 40th floor at Gillette's headquarters at the Prudential Center in Boston, Cantwell was standing against the expansive glass window overlooking the beautiful Charles river and thinking.... He had to decide if he should take the "leap", unveil the 500m tag order to Alien at the Auto-ID Center's board meeting or wait until he had more information on several unresolved issues in what would be a challenging large scale network system deployment. And once an announcement was made, there was no backtracking...

The Gillette Company

Over a century old Gillette Company had built a reputation of being a great brand with world class FMCGs (Fast Moving Consumer Goods also called CPG/Consumer Product Goods and sometimes FMCPG). Throughout its history, The Gillette Company had a history of being first at the things it did (See **Figure 1** for a list of Gillette firsts) and it had continued the entrepreneurial streak and risk-taking over the decades.

In the late 1800s, William Painter, the inventor of the disposable Crown Cork bottle cap, told King Camp Gillette that a successful invention was defined by repeated purchases by satisfied customer. "Invent something people use and throw away," William Painter advised him. This was clearly a subtle reference to the Crown Cork [that] Painter invented. One morning, in [...] 1895 while shaving, [King] Gillette had the revelation of his life. 'What if I could put a sharp edge on a small square of sheet steel? Could I create an improved safety razor blade?' The idea kept him busy for days. Six years later, he found an engineer willed to take the challenge. It was William Emery Nickerson, an MIT graduate, who was able to create the blade that Gillette dreamed of. That act marked the creation of the safe, disposable and, most importantly, inexpensive blade. [...] Those blades would soon turn into the money maker for the company. In 1901, Gillette and his chemist

colleague Nickerson incorporated the "American Safety Razor Company". This was the beginning of a new era in the history of razors.[ii]

In 1926 the year of the company's 25th anniversary, King C. Gillette wrote of the company's flagship product, the safety razor, "There is no other article for individual use so universally known or widely distributed. In my travels, I have found it in the most northern town in Norway and in the heart of the Sahara desert."[iii]

The Gillette Company is the global market leader in nearly a dozen major consumer product categories, principally in the grooming, portable power and oral care businesses. In 2001, as Gillette completes 100 years it has gained leadership positions through the company's strategy of managing a globally networked business with a long term perspective.

This demonstrated ability to generate long term profitable growth, strong brand loyalty in a changing marketplace rested on several strengths including accumulation of scientific knowledge, developing innovative products, embracing technological advances and reliable efficient and cost effective manufacturing processes.

By 2002, it had various global brands for razors, blades, power toothbrushes, batteries etc. In 2002 it had a market capitalization of more than $40 billion and yearly sales close to $10 billion[iv]. Whatever the Gillette Company sold was always positioned as a premium product and it never gave up to the temptation of low cost strategy.

Gillette had amassed a great brand reputation by the turn of the century. In 1999 Gillette as a company was worth 43 $US billion and it was estimated that the brand value of Gillette was worth 16 $US billion. This equates to 37% of the company's value which is the same as Mercedes, one of the most respectable car manufactures.[v]
(see **Figure-2** for Gillette's 3rd Quarter results for 2002)

Killer issues in Gillette's Supply chain

"Out of stock" (OOS) and "shrinkage" (gentleman's word for theft or pilferage) were major issues for Gillette.

Firstly, shrinkage was a major case of concern. With the current infrastructure, there was no way to track where each product went. Interestingly Gillette razors had the reputation of being one of the most stolen items on the planet. The primary reasons behind this were that Gillette products (Blades/Razors/Batteries/Powered Toothbrushes etc) were high value, small form factor, long shelf life and easily convertible to cash. At a global level for CPG industry, shrink represented a $30-50 billion problem. (See **Figure 3** for impact of OOS on Supply Chain). The second issue that impacted suppliers was out of stock. Many times the retailer had the suppliers product in their warehouses yet due to poor tracking infrastructure, the product did not arrive at the retail shelves on time. This led to customers either returning disappointed or substituting with a competitor's product.
Also, as companies got global and transactions across continents started happening, each stakeholder (manufacturer/supplier, transportation & logistics providers, retailers, etc) all optimized their business efficiencies on a local level. As goods crossed boundaries of stakeholders there were only limited product information or data exchange mechanisms available.

Introduction to RFID

"Automatic Identification" (Auto-ID) describes a [broad range] of technologies used for automatically identifying objects, individuals, and locations. Typical Auto-ID systems assign a code to a product model or type. This code can then be automatically read and manipulated by an information processing system. The Universal Product Code (UPC)/ European Article Number (EAN) bar code present on most consumer items sold in the world is one of the most widely used Auto-ID systems. Today more than 5 billion UPC/EAN codes are scanned world-wide on a daily basis [...].[vi]

Moving from Optical Scanning to RFID.

Currently the retail industry uses UPC popularly known as the barcode. The barcode required "line of sight" which means that the infrared signal from the barcode reader should be directed at the barcode (optical pattern) for the reader to be able to read it. In case of radio frequency, "line of sight" was not required, that is a reader (a wireless transceiver) could read an RFID tag present anywhere in the 3D space, within the range of the reader. This method of object identification using RF signals came to be known as RFID. RFID tags could be read through cloth, paper etc. Some of the benefits of RFID Tags (*see* **Figure- 4** for EPC Tag details) are that:

1. It did not require line of sight to be read and could provide real-time data by utilizing transmission technology.
2. Being an IC (Integrated Circuit), RFID could have several thousands of bytes of information as compared to barcodes.
3. Only a single barcode can be read at a time with a single reader, whereas a single RFID reader can reads hundreds of tags almost simultaneously
4. Barcodes are "read-Only" but advanced RFID Tags can read as well as write information.
5. Barcodes could be read by any reader but RFID tags can be built with password of 'secure access' features and sometimes it is also possible to deactivate or kill the tag.

Gillette for example gave the UPC code "041508 800822" to a case of a pack of 6 Sensor Excel razors. The case which contained 100 of such packs of six had a different UPC code (code "041508 800129"). Each pack inside the case had the same UPC code. A shipping container might contain hundreds of cases, all with the same code.

Each RFID tag, by contrast, can have its own unique identifying code which means that in effect each blade could have its own code, based on a system developed by MIT's Auto-ID Center. (See **Figure- 5** for UPC and EPC code description)

History of the Barcode

The history of modern barcodes began when Bernard Silver and Norman Joseph Woodland, at Drexel Institute of Technology in Philadelphia developed ink patterns that would glow under ultraviolet rays. The inventors described their invention as relating "to the art of article classification...through the medium of identifying patterns"[vii]. The system included representation of alpha-numeric codes through absence or presence of lines and the first line of the sequence was the reference line or the datum and the position of the rest of the lines were relative to the first line. Therefore if there were 10 lines in the barcode, 1023 classification could be made [210-1(minus 1 for the reference line)].

In 1974 NCR Corporation developed the first Barcode Scanner at Marsh's Supermarket in Ohio where the first product to be scanned was a 10-pack of Wrigley's Juicy Fruit chewing gum. The pack of gum wasn't specially designated to be the first scanned product. It just happened to be the first item lifted from the cart by a shopper whose name is long since lost to history. Today, the pack of gum is on display at the Smithsonian Institution's National Museum of American History[viii].
The rest is history as barcodes and barcode readers proliferated into every aspect of our lives. For a chronology of Barcode related events, see **Figure -6**)

The History of RFID Technology

It is believed that the development of RFID has its roots in World War II. In 1935, Scottish physicist Sir Robert Alexander Watson-Watt had invented the RADAR (Radio Detection and Ranging) to warn of approaching planes. However, there was no way to identify if the plane was that of a friend or a foe. So the British developed the IFF (Identify Friend of Foe) system, under Watson-Watt, a transmitter that would receive signals from the radar and send a signal back to the radar identifying it as friendly. This system of sending a signal and receiving a response is the tenet behind RFID.

In the carly 1990s, IBM engineers developed and patented an ultra-high frequency (UHF) RFID system which was later on sold to Intermec during IBM's troubled times on 1990s because they found low adoption of this technology due to lack of international standards.[ix]

During the same time, the retailers were pushing for adoption of EAS (Electronic Article Surveillance). EAS had a binary code single switch which was either 'on' or 'off'. So if someone carried an item out of the retail store and the EAS tag was not removed or put 'off' it would initiate an alarm. The EAS was expensive, had limited "presence" detection use but still was favored by the retailers as they associated "shrinkage" with theft within the stores. Also, two different standards prevailed for EAS – Tyco Sensormatic and Checkpoint.

Dick Cantwell believed that shrink occurred not merely from the store front but due to a poor process along the supply chain. Incidentally, Gillette UK had been trying to understand 'shrink' in the supply chain as a problem that was more than mere on-the-store theft or pilferage and they stumbled upon RFID as a technology. Around the same time Proctor and Gamble (P&G) was also looking at addressing shrink because their high value, small size beauty products were going though similar issues. Under Dick's leadership Gillette steered the way to establishing the Auto-ID center at the Massachusetts Institute of Technology (MIT) in partnership with P&G and UCC/EAN (The barcode standards body - Uniform Code Council/International Article Numbering for Europe). Two professors at MIT, Sanjay Sarma and David Brock, were doing some leading edge research in the area of low-cost RFID tags and tracking. Their concept they developed was a unique numbering system called EPC or Electronic Product Code (see Exhibit), keep the numbering within the tag and have the database creation independent of the tag accessible through the internet. Tags would no longer be mobile databases. This was a paradigm shift for the RFID industry which would reduce the cost of the tags, allow manufacturers to tag each item and hence track the location of millions of products on a real time basis as well as share the information with their retail partners and suppliers.

The Concept of EPC

Adapted from White Paper on RFID Systems and Security and Privacy Implications by Sarma, Weis and Engels[x]

The four key components of [the RFID system developed at the MIT Auto-IC center] are the Electronic Product Code (EPC), the Object Name Service (ONS), the Savant, and the RFID transponders.

The EPC. The EPC is an identification scheme designed to enable the unique identification of all physical objects. This is the only data required to be stored on a tag, for once the unique identity of an object is established, information about that object can be obtained from the network. As such, the EPC acts like a pointer to this information. [The 96 bit EPC code which provides unique identifiers for 268million companies and each manufacturer can have 16 million object classes and 68 billion serial numbers in each class. Since there will not be a need for such large numbers to begin with Auto-ID labs suggested an interim 64-bit code.]

The ONS. The Object Name Service (ONS) is a directory service that maps the EPC to an IP (Internet Protocol) address where information about the associated object can be written and/or accessed. The ONS is based entirely on the Domain Name Service (DNS), the directory service used on the Internet today to map a domain name (e.g., www.mit.edu) to an IP address (e.g., 18.181.0.31). At the IP address pointed to by the ONS, data about the particular object is stored in XML format, and can be accessed by standard methods like HTTP [...].

Savant [or the] Middleware. The Savant system is a hierarchical control and data management building block that can be used to provide automated control functionality and manage the large volumes of data generated by the RFID readers. A Savant enables the distributed creation of a reader network by acting as a gateway to the next higher level in the Savant hierarchy, effectively isolating the reader sub-network. [...]

RFID Transponders. RFID transponders are the most numerous and cost sensitive of [the] system components. [...] RFID protocols [are designed] for both 13.56 MHz and 915 MHz, both with the aim of having minimum cost identification tags with acceptable performance for supply chain applications. Both transponders are designed to store a unique identifier, an EPC, and have that identifier retrieved as part of the anti-collision algorithm [when the reader reads hundreds of tags/EPC codes this algorithm ensures that the signals do not collide with each other and create gibberish information].

Key Components of RFID

In a typical RFID system, individual objects are equipped with a small, inexpensive tag. The tag contains a transponder with a digital memory chip that is given a unique [EPC]. The interrogator [or the Reader], an antenna packaged with a transceiver and decoder, emits a signal activating the RFID tag so it can read and write data to it. When an RFID tag passes through the electromagnetic zone, it detects the reader's activation signal. The reader decodes the [EPC] data encoded in the tag's integrated circuit (silicon chip) and the data is passed to the host computer. The application software on the host processes the data, often employing Physical Markup Language (PML). [...][xi]

RFID Tags

Adapted from White Paper - The Networked Physical World by Sarma, Brock & Ashton, MIT Auto-ID labs[xii]

Tags are devices with non-volatile memory that can be [read] remotely. Usually, radio frequency (RF) tags have memories ranging from a few bits to several kilobytes and communicate with the tag reader at frequencies ranging from 100 kHz to several GHz. Tags can be classified in several ways, such as by the transmission technology, the transmission frequency, the range, whether the tag is powered or not, the size of the memory, read-write capability, and anti-collision algorithm. [...There are] of more than

fifty RF tag manufacturers world-wide, and there are several combinations of technologies available. [...]

There are two types of RFID tags:

Passive RFID tags - Passive tags can be as small as 0.3mm and [have no internal power supply]. Rather, they are powered by the radio signal of a RFID reader, which "wakes them up" to request a reply. Passive RFID tags [have almost unlimited lifespan and] can be read from a distance of about 20 feet. Semi-passive RFID tags contain a small battery that boosts the range. Passive tags are generally read-only, meaning the data they contain cannot be altered or written over.

Active RFID tags - Active tags, also called transponders [also known as beacons[xiii]] because they contain a transmitter that is always "on", are powered by a battery, about the size of a coin, [have a life span of about 3-5 years] and are designed for communications up to 100 feet from the RFID reader. They are larger and more expensive than passive RFID tags, but can hold more data about the product and are commonly used for high-value asset tracking. Active RFID tags may be read-write, meaning data they contain can be written over.

RFID Readers

RFID readers, also called interrogators, first and foremost are used to query RFID tags in order to obtain identification, location, and other information about the device or product the tag is embedded in. The RF energy from the reader antenna is collected by the RFID tag antenna and used to power up the microchip. There are two types of RFID readers: RFID read-only readers. [...] and RFID read-write readers also known as encoders [...][xiv]

Supply Chain Benefits of RFID

Some of the major benefits of RFID in the area of supply chain are listed below:

Minimize Out of stocks (OOS): Manufacturers lose a lot of revenue just because the product is not available on the retail shelf when the customer goes to purchase it. This situation is called "out-of-stock". An RFID system provides visibility to the products on the shelf, in the ware house and those in transit. By appropriately using the data and moving the products it is possible to minimize an 'out-of-stock".

Reduce/Eliminate Shrinkage: Shrinkage is the gentleman's terminology for theft. Products like the Gillette -razors that are small in size and high in value can easily be shop-lifted by employees and customers. An RFID tag attached to it can track the movement of products and prevent them from unauthorized movement outside a specified boundary.

Prevent Diversion: Since the current system of UPC code would have the same code for all products in a carton or even a truck full of products, it is difficult to segregate or divert products based on pricing or promotional schemes and divert them to different parts, say one for military consumption and other for general consumer.

Prevent Counterfeit: Barcodes can easily be duplicated while RFID tags can have embedded information which can be authenticated and so prevent counterfeit. This is especially important for pharmaceutical products and high value FMCGs.

Helps Reconciliation: Oftentimes a supplier may supply to the retailer, same product at two different price points - One for direct consumer (usually higher price) and other for pharmacies or military. When some products are unsold, the retailer would return the products and allot maximum possible returns under the consumer category. This would allow the retailer to sell lower priced 'pharmacy' products, which it retained, to more consumers at higher price. Most suppliers would 'write-off' amounts less than $100

because the cost of reconciling or litigating was much higher than about $100. Sometimes this "write-off" itself would incrementally run into several thousands of dollars over a year. RFID can help such reconciliation easily.

Obsolescence prevention: Even in the best managed warehouses of large retailer handling millions of products, there are several items that lie undetected and get obsolete. RFID would provide visibility to the items and their locations thus helping prevent obsolescence.

Product planning: If implemented effectively, RFID systems can provide real-time data on the movement of products which can help product planners build patterns of consumer behavior and marketers can accelerate or decelerate the products to the market thus minimizing the financial impact of good in transit.

Promotions management: It has been observed that, if a promotional advertisement appears on in the retail store ahead of time, it cannibalizes the purchase of the item at higher value and if the advertisement appears late, it impacts sale negatively. If the RFID tags are activated on the day of the 'sale', the consumer gets the promotion immediately and minimizes the losses of delayed communication.

VMI (Vendor Managed Inventory): Since retailer like Walmart can provide visibility to the movement of products to the suppliers (vendors) like Gillette, Walmart can reduce its inventory in the warehouses and ask Gillette to provide products on a jut in time basis or keep the inventory in Gillette's warehouses until needed by Walmart. Such

Reverse Logistics: When products are returned, the reverse logistics of getting the product back to the manufacturer is an arduous task. Let's say a drug with serious side effects hits the market and the manufacturer has to recall the product from the market. RFID helps track each item on the market and its current location. Such facilitation can prevent companies from serious brand damage and lawsuits. (Also see 'Helps Reconciliation' above)

Asset Tracking: RFID makes it possible to 'Track and Trace' products.

Contactless payment: RFID tags can store electronic money and deduct or pay at required locations. Some of the applications are in Smart-Cards that allow contact less payments, including the kind of cell-phones that NTT Docomo is working on in Japan.

Loyalty programs: Marketing, Supply Chain and Customer service departments in most companies are working with conflicting short term objectives, especially while implementing loyalty program; and the data provided by RFID can be used to globally optimize their priorities and help these departments work in a more integrated manner and efficiently implement such programs.

Electronic Proof of Delivery (e-POD): RFID can be used to track deliveries and also provide proofs of such deliveries including information about the recipient, location time etc almost in real-time.

Pitfalls of RFID

Some of the current disadvantages of RFID systems include: Emerging Standards, Tag costs, Read rates, Interoperability, Privacy issues, Barcode Legacy systems, and to some extent patent issues etc

Tag costs: The Tag cost has been a major bone of contention between technologists and business managers. The issue is to work out the right stage of tagging – At the item level or the Case level. For a 'chewing gum' that costs 50c, it may not make sense to have a tag at either 30c or even 10c. In such cases it may make sense to put a single tag on a case of 100 or 1000 chewing gums. In that scenario, it is difficult to make the best use of RFID technology to the last item in the case.

Read rate: The read rate referred to the percentage of tags that the readers were capable of reading when a large quantity of tagged items passed through the reader's range. The

current read rate is about 85-90%. How do companies reap the benefit of using RFID with such read rates?

Standards, Interoperability and frequency issues: There are four major frequency ranges that RFID systems operate at. As a rule of thumb, low-frequency systems are distinguished by short reading ranges, slow read speeds, and lower cost. Higher-frequency RFID systems are used where longer read ranges and fast reading speeds are required, such as for vehicle tracking and automated toll collection. Microwave requires the use of active RFID tags.[xv]

Frequency	Range	Tag cost	Applications
Low-frequency 125 - 148 KHz	3 feet	$1+	Pet and ranch animal identification; car keylocks
High-frequency 13.56 MHz	3 feet	$0.50	library book identification; clothing identification; smart cards
Ultra-high freq 915 MHz	25 feet	$0.50	Supply chain tracking: Box, pallet, container, trailer tracking
Microwave: 2.45GHz	100 feet	$25+	Highway toll collection; vehicle fleet identification

Source: www.rfid-101.com

RFID systems typically operate in the ISM (Industrial, Scientific and Medical) and other free bands (9kHz-135 kHz; 13.56MHz; 868-870 Mhz in Europe; 902-928 Mhz in the United States.)

The standards scenario in the RFID industry was quite messy. There were three parties working on it – Uniform Code Council, International Standards Organization (ISO) and Massachusetts Institute of Technology (MIT). A widely referenced standard in the RFID market is ISO 15693 used for Contactless cards (like to ones used in speed pass). ISO was also working on the 18000 series for RFID. The only common platform that ISO and UCC/EAN agreed to work together was the development of tags on the 13.56MHz frequency. There were several open and proprietary standards for different components of the RFID systems and the platforms differed based on manufacturer to manufacturer.

A few organizations [were] working on getting those standards by next year. According to Steve Halliday, chairman of the ISO work group that is developing RFID standards and president of High Tech Aid, four of six standards will be 95 percent to 98 percent complete and two more will be 70 percent to 80 percent complete by mid-September 2003xvi. Like the ISO, UCC also had a fairly long standard setting process and the standards for different frequencies were are different stages of the process. (See **Figure -7** on standard setting process for UCC). Most tags worked on frequencies, which did not require a license, including 125-134 KHz, 13.56 MHz, 868-928 Hz (UHF), 2.45 GHz and 5.8 GHz. Each had its own strengths and weaknesses and played a significant role in the pricing of various components within the RFID systems. For the same application different frequencies were available in different countries which created a great disparity in performance.

Helen Duce, Auto ID Center Europe, described how The Internet of Things is becoming real with cases tagged with simple number plate RFID moving across 8 states of the US, interrogated on the Internet. Policy on standards is to shun ISO and create their own de facto standard, said Helen. This will be available at the end of 2003[xvii].

The key players in the RFID space were also to a small extent concerned about Intellectual Property issues surrounding RFID. It was believed that Intermec and Symbol were two companies who had some 'submarine patents' around RFID and they would 'surface' once mass adoption happens.

Privacy Issues

RFID makes it easy to invade personal privacy by gathering information about consumer behavior. The RFID tag contains information which is read by readers or wireless devices that are available for public purchase. This makes it easy for companies and individuals with profit related or nefarious intent to collect information on people and use it for their own benefit or to harm the person whose data is collected. Due to this fear, there was a lot of opposition by consumers to some kinds of application in the retail industry.

Key Players in the RFID space

MIT Auto-ID Center

The Auto-ID Center at the Massachusetts Institute of Technology was set up in 1999 with sponsors, including Coca-Cola, Gillette, Target, Home Depot and Wal-Mart. The objective of the center id to help create the infrastructure, develop the standards, and identifying applications for RFID. Technologies and standards developed at the Auto-ID Center are distributed as open source. Says Sanjay Sarma, the co-founder of Auto-ID center, 'We envision the use of physical tags that allow remote, Contactless interrogation of their contents; thus, enabling all physical objects to act as nodes in a networked physical world. The realization of our vision will yield a wide range of benefits in diverse areas including supply chain management and inventory control, product tracking and location identification, and human-computer and human object interfaces. Our vision of ubiquitous automated identification technologies and their applications drives our research agenda and goals'.[xviii]

'At 5¢, our research shows that total demand will be explosively larger. At about 1¢, the demand for RFID tags may well equal that for bar codes. The achievement of the 5¢ goal will therefore likely create a new problem until now unknown in the RFID community: production capacity limits[xix]." says Sarma.

UCC/EANI

The Uniform Code Council (UCC) and the International Article Numbering Association of Europe were the de facto standards body for the UPC and were leading the movement in the RFID space

International Standards organization

The International Standards organization (ISO) had several standards around different equipment and products in different countries and used for different applications. However they were still working on an internationally overarching standard for RFID. The ISO 18000 series was being developed for RFID.

Wal-Mart

Wal-Mart operates discount retail department stores selling a broad range of non-grocery products, though emphasis is now focused on the "Super-centers" which offer a full line of grocery items. Wal-Mart also operates Sam's Club, a "warehouse club" [...] that sells discounted bulk merchandise to dues-paying members. Due to Wal-Mart's success in selling consumer goods and its necessary focus on more expensive items (and larger population areas) to increase revenue, a niche has been carved out of Wal-Mart's dominance by several [...] retail corporations.[xx]

In 1999 Wal-Mart with 1,140,000 employees, became the largest private employer in the world. Wal-Mart went public in 1975. Since then its stock has climbed from 5 cents (split adjusted) to a high of $63 in March 2002. [In 2002, Walmart had a net sales revenue of $217.8 billion[xxi]] Wal-Mart benefits from economies of scale in manufacturing and logistics; the purchase of massive quantities of items from its suppliers combined with a very efficient stock control system help make Wal-Mart's operating costs lower than those of its competitors. They are leaders in the field of vendor managed inventory—asking large suppliers to oversee stock control for a category and make recommendations to Wal-Mart buyers. This reduces the overhead of having a large inventory control and buying department. Wal-Mart's vast purchasing power also gives it the leverage to force manufacturers to change their production (usually by creating cheaper products) to suit its wishes: a single Wal-Mart order can easily comprise a double-digit percentage of a supplier's annual output. One particular aspect of the economy of scale is the aggregation

effect [...] whereby Wal-Mart sells as many different items as possible. This allows the company to grow revenue over its fixed cost base (more sales out of the same store). [...In fact] Wal-Mart [is also credited with pushing] the retail industry to adopt UPC codes and bar-code scanning equipment. [xxii]

Department of Defense

The DoD had been active in the RFID space with niche defense related applications. One of their main areas of focus has been RFID based multi-application smart cards for authentication and access control to defense networks and systems thereby increasing security through common access cards (CAC). The Department of Defense received the 2002 Outstanding Smart Card Application (OSCA) Award from the Smart Card Alliance.

[...]Currently the CAC issuance system is operational in 300 locations worldwide. [...] Said [Mary] Dixon, [Mary Dixon, Director of the Department of Defense Access Card Office] "This technology allows us to secure our unclassified networks and aggressively pursue the implementation of many electronic business applications."[xxiii] (See **Figure 8** for DoD's tag orders and prices)

Alien Technologies

Alien had developed a technique called fluidic self assembly (FSA) for micro display technology but the yields were not high enough to provide ROI for that need. Incidentally, this technology was conducive for manufacturing RFID tags and evoleved as the next-generation manufacturing technique which allowed manufacture of millions of tags at low costs. In fact Aliens production technology was moving towards the price points predicted by Sanjay Sarma of MIT, which he developed as a function of silicone price that follows Moore's Law and the die cost that would reach an inflexion point beyond a certain minimum size of the silicone.

In 1999, Cantwell was traveling to Japanese universities to identify partners for the MIT Auto-ID labs and the CEO of Alien Jeff Jacobsen was traveling in the same bullet train. They started a conversation and both got interested in each other's RFID initiatives over some back of the envelope calculations and over subsequent several months worked closely to see opportunities to work together. By 2002, Jacobsen was succeeded by Stov Pedromo as the new CEO of Alien and Dick hoped that the bullet train that started of the association did not alter its speed because of the management change.

"Prices [of tags] have been falling steadily, but the capability of the current technologies is going to reach its limit soon. That's where we come in. With our FSA technology, it gives us very high capacity in a cost-effective way," said Tom Pounds, VP of marketing and development at Alien Technology. "The market will not grow as long as tags cost 30 cents to 50 cents. Somebody needs to be leading the way allowing the market to evolve," Pounds said. "We're trying to lead the way down the cost curve to let the leash off the market." [...][xxiv]

ThingMagic

ThingMagic was one of the leading manufacturers of RFID readers.
At the encouragement of MIT Auto-ID Center, they [were] working on a multi-protocol HF and UHF reader. [...] In their readers, they separate band modules from protocol modules but they can do multiple protocols and frequencies at the same time [and thus developing] scaleable, low-cost readers [...][xxv]

OAT Systems

OAT Systems, an RFID software company co-founded by Sanjay Sarma, was a key player in developing the middleware for capturing and analyzing the data from the tags. OAT had partnered with Gillette to develop applications to use the data.

Management Challenges and RFID

Dick Cantwell saw a new opportunity through RFID to identify products which were supposed to be at a certain place but is not present there. If this could be accomplished, it would increase productivity, accuracy and customer service. Cantwell had worked very hard at internally selling the idea of RFID within the company, from employees to the top management. He established a common vision for RFID as a platform that would provide product visibility and work process improvement. Together with Kevin Ashton (Associate Director at P&G on loan to MIT Auto-ID Labs as Executive Director) and Sanjay Sarma (Research Director at MIT Auto-ID Center and a key Architect of EPC), Cantwell drove the single platform vision for RFID. In June 2001, Cantwell was elected as the Chairman of the Board of Overseers at MIT Auto-ID labs. He knew that roping in large retailers who carried Gillette's products would be a key to adoption. To share the technology and the thoughts, he invited a Walmart senior executive for a dinner that Cantwell hosted for key members of the Auto-ID center in October 2001. Walmart was excited at the new opportunities that the technology provided and agreed to be part of the Auto-ID initiative.

Cantwell's initial discussions with the Gillette board included review of the business case, making sure the standard deviations and confidence intervals were within acceptable risk limits. Cantwell recalls, the Chairman asked "Will it increase retail availability?; will it reduce shrinkage?; Can it help with our inventories?". Cantwell and his team's answer was 'yes' to all from a technology standpoint but the required network effects within the industry was not present to harness that potential. For that Cantwell proposed a model in which the technology standards were "open" to their partners in the supply chain so that there could be wide adoption faster. This would allow Gillette to take a smaller share (of greater value) of a larger pie than vice versa. Gillette's top management was very tech-savvy and believed in reaping business benefits through technology. Cantwell's persistence paved way for the management's approval for "launch and learn" more of RFID implementation process within Gillette.

To validate his thoughts, in early 2002, he got PriceWaterhouseCoopers (PWC), a consulting company to do an ROI (Return on Investment Analysis) on RFID investments for Gillette. With the decision to partner with Alien PWC reported a 28.1% ROI on retail unit tagging and 27.2% ROI on pallet tagging. The report measured the effectiveness of the two key objectives of Gillette's initiative – To be an early adopter of Auto-ID technology and accelerate the potential of broad Auto-ID adoption to improve efficiency in the supply chain process. The report also reinforces Gillette's belief that Gillette could significantly influence the standard setting process fro Auto-ID.

The Cantwell's conference table was scattered with printouts and news articles from the RFID industry and some of them read...

- The RFID tag market was $76 million in 2000 and is projected to reach $330 million by 2005, according to David Krebs, group manager of research firm Venture Development Corp. in Natick, Mass. The hardware for this market, which includes tags and transceivers, was $660 million in 2000 and is forecast to be worth about $2 billion in 2005, Venture Development said. [...] But RFID has many hurdles to overcome, such as industry recognition, visible return on investment, cost, standards—not to mention unseating its chief competitor: bar coding. [...] Bar codes can be corrupted and become unreadable, while RFID tags are fairly indestructible and reusable.[xxvi]

- The European Central Bank is quietly working to embed RFID tags in the fibers of Euro banknotes by 2005. The tag would allow money to carry its own history by recording information about where it has been, thus giving governments and law enforcement agencies a means to literally "follow the money" in every transaction. If and when RFID devices are embedded in banknotes, the anonymity that cash affords in consumer transactions will be eliminated.[xxvii]

- Alien Technology recently won a $120 million contract from the Department of Defense to combine RFID tags with other types of sensors to pick up vibrations or

detect the presence of chemicals or biological agents. The U.S. military wants to drop so-called "smart dust" sensors on a battlefield and by picking up vibrations and knowing the exact location of a specific tag, generals could know how many enemies are hiding in a location or whether chemical or biological weapons are being stored there. RFID tags may even be combined with tiny microphones that look like seed burrs that could attach themselves to someone's socks, so the military could listen in on conversations.[xxviii]

- Paul Groves of Miyake said that the RFID scene in Japan is defying the recession with many air baggage trials and installed road tolling schemes. NTT is putting RFID in cell-phones to pay for things etc.[xxix]

- A report released in October 2002 by AMR Research Inc. says early adopters of RFID tags have cut supply-chain costs by 3 to 5 percent and have achieved 2 to 7 percent increases in revenue thanks to the better inventory visibility the tags provide." And "RFID tags have made headlines recently because the cost of producing them has plummeted to as little as 15 cents apiece for some varieties.[xxx]

As the moonlight gleamed over the bright Boston nightlights and as Cantwell prepared for the meeting he had to consider several issues....

Tags, Costs and Business Processes

1. What type of tag best fit his business? What should be the tag price? Should barcodes co-exist with RFID tags on the products? Should he place a tag on the individual items or their cases? (See **Figure 9** for Tag cost forecasts)
2. The new technology will be disruptive in nature and can initiate several business process changes. What could be the challenges of an enterprise-wide deployment? (See **Figure 10** for Capex components effected by RFID)

Technology Adoption and Network Effects

3. Even if Gillette got the tags in place, there won't be readers on the retail shelves or along the supply chain.
4. The read-rates of the present readers were only 85-90% and reader manufacturers could not sell the readers until there were sufficient tags in the market.
5. Automatic data capture will be the greatest benefit of RFID, but there was no established software or method existing that could help make sense out of this colossal amount of data and information. More so it required integration with the retailer's systems.
6. Most RFID applications till date have been on high value items and in closed-loop processes. It had never been tried in an open-loop form that did data interchange with internet, cell-phones, and trucks all the same time!

Standards

7. What standard should Gillette follow?
8. Was Auto-ID's EPC the right standard to invest in?
9. Even if Gillette adopts a certain standard and put all the data systems in place, will be easy to get agreements in place with the Retailers? (see **Figure-11** for Tag type vs Potential Applications)

Socio-Political and Government Intervention

10. Once the RFID movement picks a critical mass, will the government intervene? Will there be a standards war or will there be a government mandate?
11. The Consumer Privacy issue surrounding RFID was decelerating the adoption of RFID. No one was sure, in what ways and form, data can be collected and how it can be used. People were afraid of companies inconspicuously spying on them. Some people said to the extent that "I do not want the RFID tag to announce the brand of my underwear, and then recruiters trying to assess my personality!"

Figures

Figure 1: Gillette firsts[xxxi]

- Safety razor (Gillette Safety Razor 1901)
- Razor designed specifically for women (Milady Décolletée, 1916)
- Razor dispenser (1946)
- Stainless Steel blades (Super Stainless, 1963)
- Double-blade razor (Trac II, 1971)
- Disposable double-blade razor (Good News!, 1971)
- Razor with a pivot point (Atra, 1977)
- Razor with a lubricating strip (Atra Plus, 1985)
- Razor with spring-loaded blades (Sensor, 1990)
- Razor with microfins (Sensor Excel, 1995)
- Razor with three blades (Mach 3, 1998)

Figure 2: Excerpts from Gillette's 2002 Third Quarter Results

Driven by strong growth of new products and solid cost savings net income for third quarter climbed 20 percent. Profit from operations for the quarter was $522 million up ten percent from $473 million in the previous quarter due to cost saving initiatives. For the nine month ended September 30, 2002 sales grew 5% to 5.92 billion without any material effect of foreign exchange.

Product category	**Sales revenue for 9 months- 2002**	**Key Products**
Blades and razor	$2.54 billion (profit $989 million up 18%)	Mach 3, Mach 3 turbo, Venus (women's)
Duracell	$1.24 billion (down 3%)	Duracell batteries
Oral care	$861 million (Profit $163 million, no change from previous year	Oral-B power tooth brushes
Braun	$685 million, up 5% (profit $47 million, down 28%)	Home applainces
Personal Care	$595million, up 2%	Shaving creams, gels, after shave, deodorants etc.

Company's working capital initiative continued substantial progress (for instance, inventories were reduced by $134 million versus prior year) contributing to free cash flow of 1.2 billion, an increase of 44%.

Continued on Page 41

Unaudited consolidated income statement (Millions of dollars, except per share amount)

	Three months ended September 30		Three months ended September 30	
	2002	2001	2002	2001
Net Sales	2168	2123	5924	5666
Profit from Ops	522	473	1299*	1167
Income before taxes	513	429	1261	1029
Income taxes	159	133	391	319
Net Income	354	296	870	710
Net Income per common share – Basic	0.33	0.28	0.82*	0.67

*Includes a $30 million gain from sale of Vaniqa or two cents per common share.

Figure 3: Impact of Out of Stock (OOS) on the supply chain[xxxii]

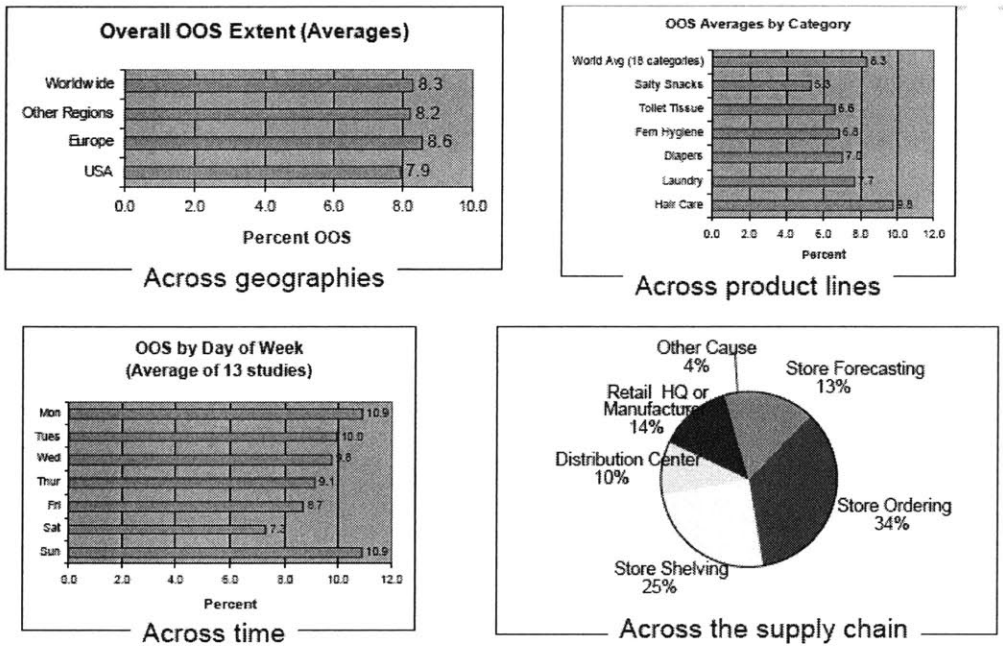


Figure 3 continued on Page 42

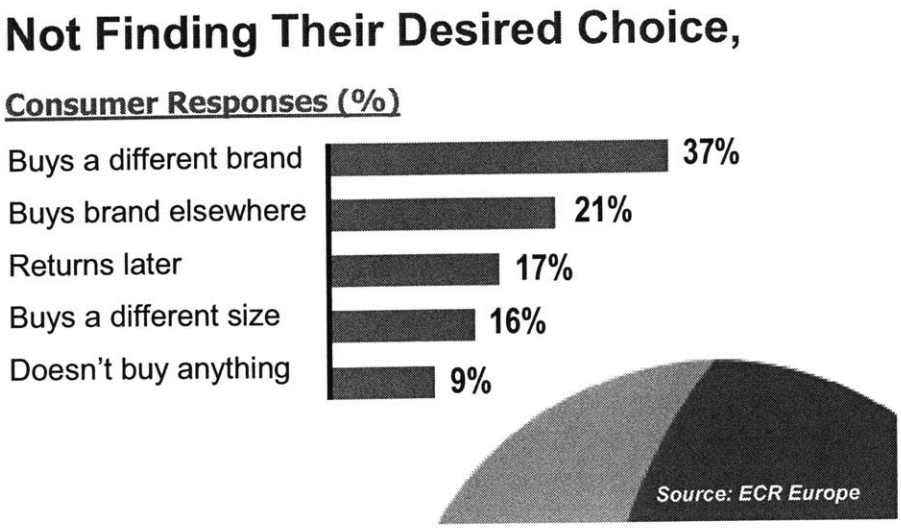


Figure 4: The EPC Tag Code

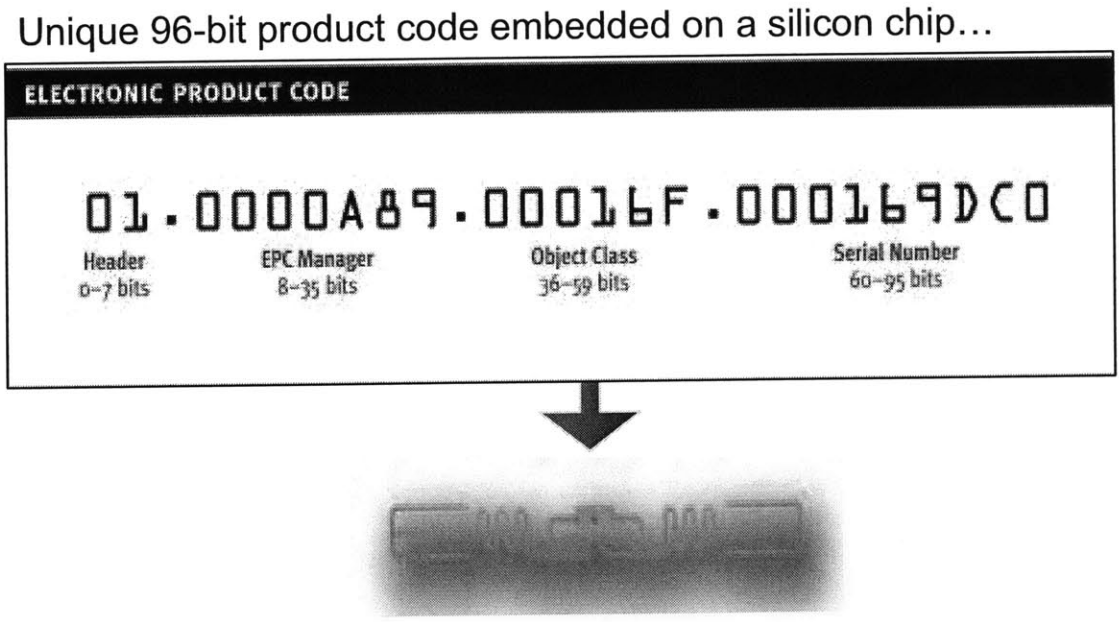


Figure 5: A typical EAN-13 barcode[xxxiii]

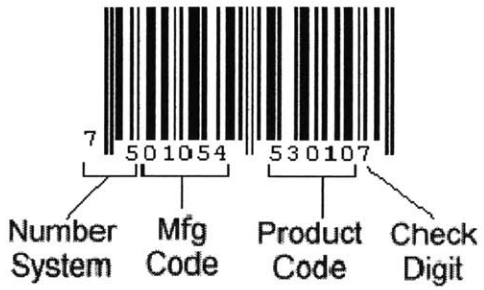


Figure 6: History of the Barcode[xxxiv]

1932	Punched card based merchandise tracking developed at HBS
1948	Bernard Silver & Norman Joseph Woodland of Drexel Institute of Technology in Philadelphia develop the first modern version of barcode
1949	Woodland and Silver filed a patent application titled "Classifying Apparatus and Method
1950's	Industrial application of automatic identification was begun in the by the Association of American Railroad
1966	The National Association of Food Chains (NAFC) put out a call to equipment manufacturers for systems that would speed the checkout process.
1967	RCA installed one of the first scanning systems at a Kroger store in Cincinnati. The product codes were represented by "bull's-eye barcodes"
1973	U.S. Supermarket Ad Hoc Committee recommended the adoption of the UPC symbol set still used in the USA today.
1974	One of the first UPC scanner, made by NCR Corp. (which was then called National Cash Register Co), was installed at Marsh's supermarket in Troy, Ohio. On June 26, 1974, the first product with a bar code was scanned at a check-out counter. It was a 10-pack of Wrigley's Juicy Fruit chewing gum.
1981	United States Department of Defense adopted the use of Code 39 for marking all products sold to the United States military. This system was called LOGMARS (Logistics Applications of Automated Marking and Reading Symbols)
1992	Woodland was awarded the National Medal of Technology by President Bush

Figure 6 continued with Decades of RFID on page 44

The Decades of RFID[xxxv]

Decade	Event
1940 - 1950	Radar refined and used, major World War II development effort. RFID invented in 1948.
1950 - 1960	Early explorations of RFID technology, laboratory experiments.
1960 - 1970	Development of the theory of RFID. Start of applications field trials.
1970 - 1980	Explosion of RFID development. Tests of RFID accelerate. Very early adopter implementations of RFID.
1980 - 1990	Commercial applications of RFID enter mainstream.
1990 - 2000	Emergence of standards. RFID widely deployed. RFID becomes a part of everyday life.

Figure 7: Standard Setting Process at UCC/EAN[xxxvi]

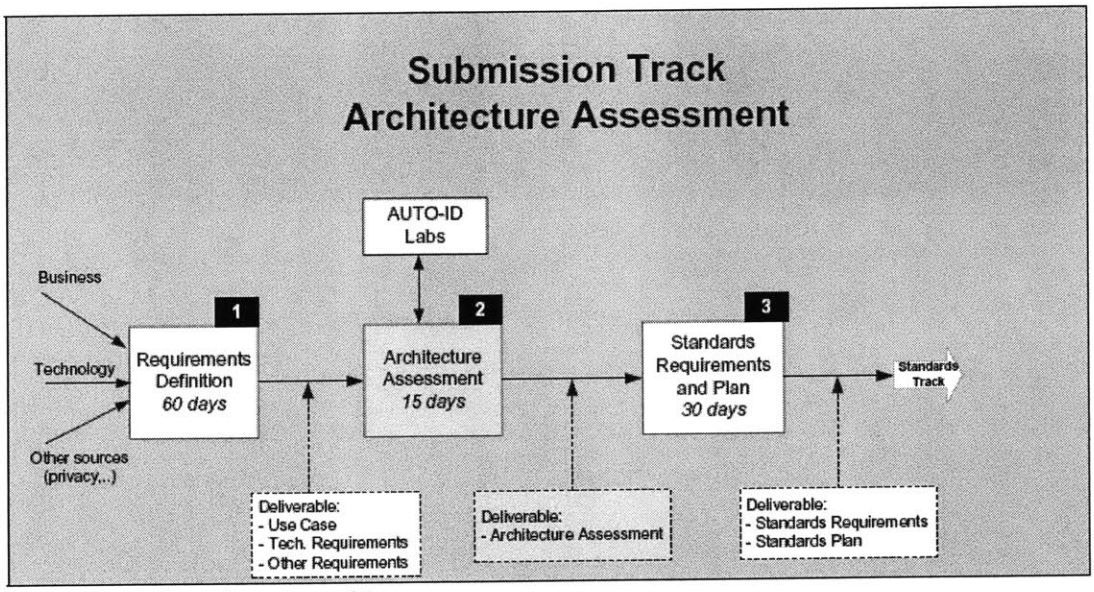


Figure 7 continued on page 45

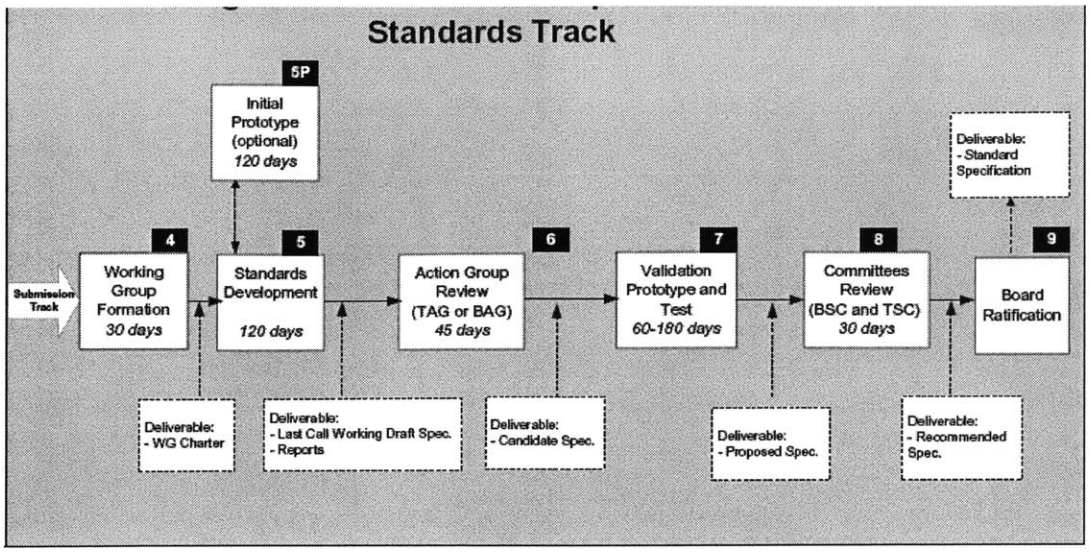


Figure 8: DOD Active Tag Purchases from December 1997

Calendar year	Quantity purchased	Purchase costs
1997[a]	10[a]	$1,400[a]
1998	23,762	$3,755,732
1999	78,145	$12,581,345
2000	27,836	$3,857,648
2001	27,733	$3,267,352
2002	58,286	$5,747,210

Source: Adapted from US Government Accountability Office[xxxvii]

Figure 9: Forecasting the Unit Cost of RFID Tags[xxxviii]

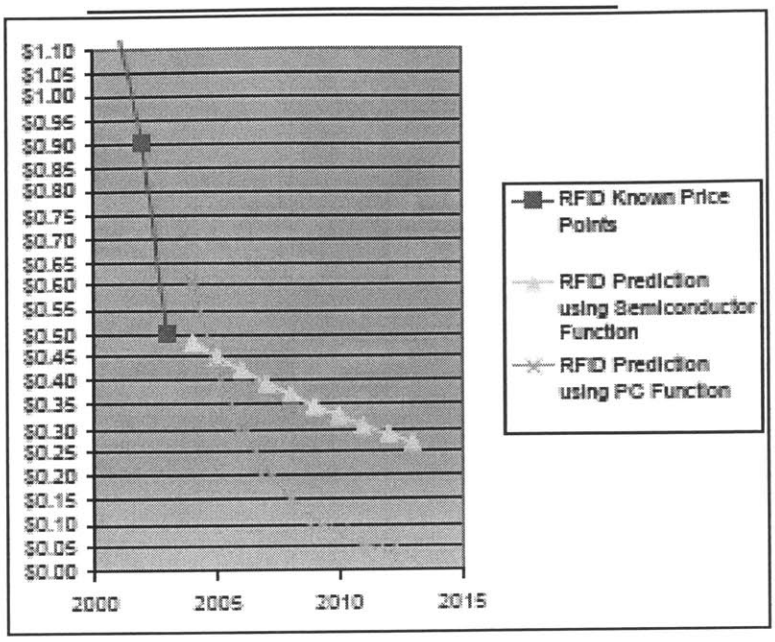


Figure 10: RFID Capex Components[xxxix]

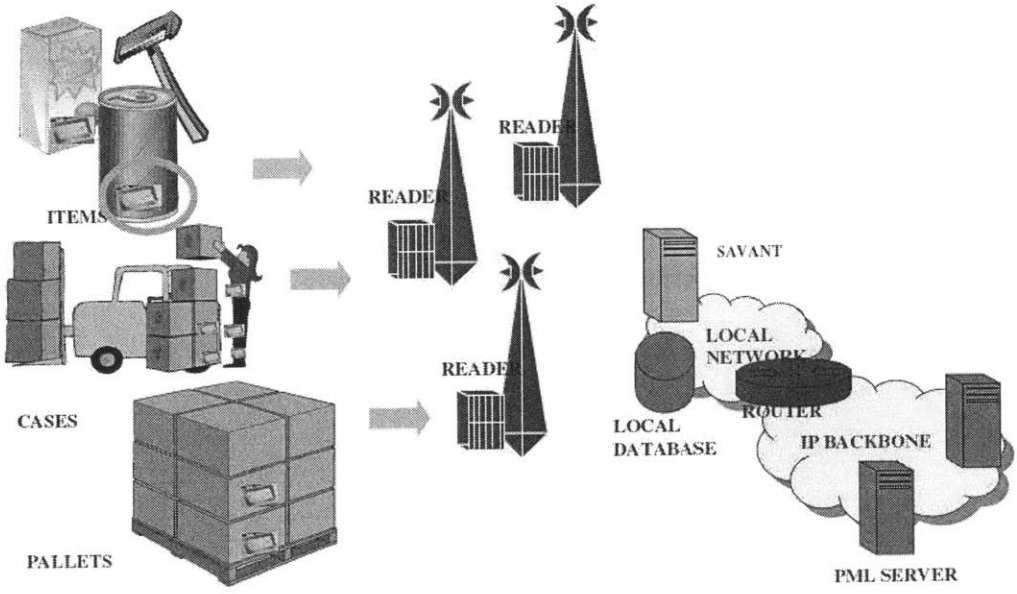
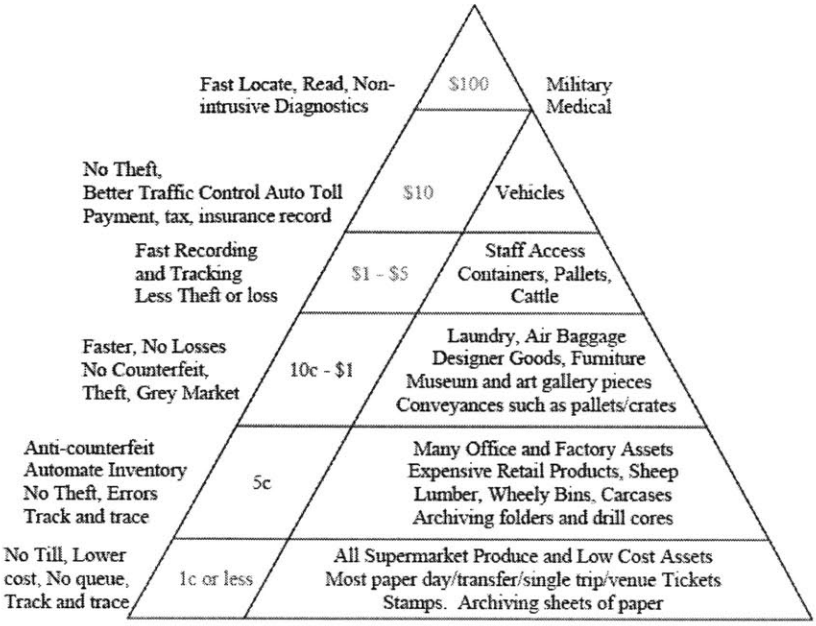


Figure 11: Potential RFID Applications at different Tag prices[xl]



Section 3

Gillette's Decision: Framework Notes

RFID primarily represents a Connectivity Network. This means that it helps connect the product tags to the readers. In most supply chain applications the Reader knows which tag it is looking for. In a smaller sense it also represents a Variety network (as the platform provides access to diverse set of compliments, including tracking, Contactless payments, medical application etc); and to some extent a Matching Network (when combined with the World Wide Web (W3C) Consortium's "Internet of Things" initiative, it can be used to match consumers to products based on behavior mapping). As technology develops, the Variety and Matching sides of the network will grow substantially touching financial services, transportation, retail, health care systems etc..

Gillette: Why Race to capture market share/ GBH (Get Big Fast)?

Form a Gillette standpoint, a successful implementation of RFID will take them to a WTA situation in the razor industry. This is because network effects are high, multi-homing costs are high and the need for differentiation is low. Thus being the first mover, Gillette can gain significant profitability through an optimized supply chain and by the time the competitor catches up, Gillette can provide competitive prices therefore capturing maximum market share.

Was Gillette's move smart? It is clearly a case where Gillette sees increasing returns to scale coupled with high multi-homing/ switching costs that create a situation for GBH or race to gain market share. By creating a large pool of tags in the market, Gillette will also be making the network dynamic which will increase the WTP (Willingness to Pay) of other players to be affiliated with or committed to the platform. As Gillette is not in the 'fighting' mode, the likelihood of such a standard adopted by Gillette becoming de facto is highly plausible. It is also a case of Joint Platform Sponsorship as Gillette collaborated

with Wal-Mart, P&G, Coca-Cola etc under the auspices of the MIT Auto-ID labs. From the above sequence of events, clearly Gillette succeeded in creating a huge network effect, collaboratively controlling the platform, mobilizing the network (to attract more users to tag side of the network), aiding the evolution of the platform and subsequently establishing a de facto standard without government intervention.

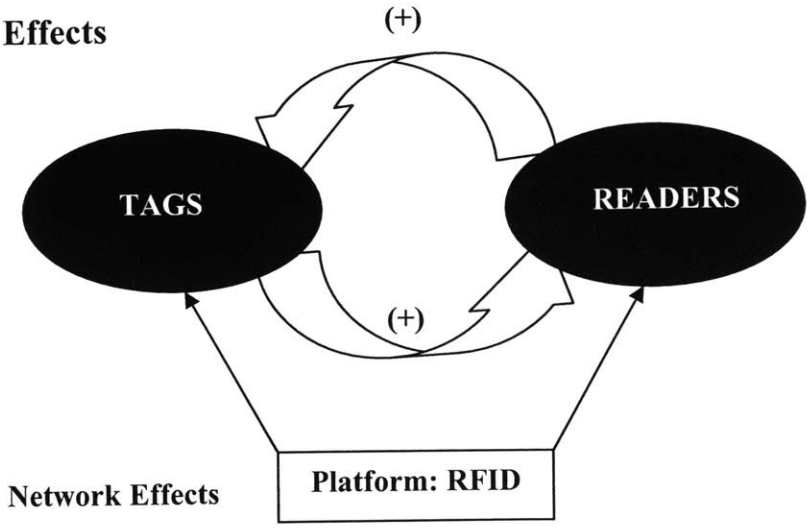


Figure 12: Network Effects

More readers and more tags are highly complementary and the network effects are strong on both sides. The Tag side will primarily represent the supplier/manufacturer side and the Reader side will be the Retailer. Also the same side network effects are also high, which means that more the suppliers that use RFID tags even more suppliers will join the bandwagon and similarly in case of Readers/Retailers.

Multi-Homing costs

Multi-homing costs are HIGH for the retailer (Reader Side) if they have to keep both barcode scanners and RFID readers in the same location. The RFID readers are expensive and range from $500- $3000 depending on the retail application.

On the Suppliers side (Tag Side), the cost to supplier will be HIGH if they have to provide both RFID tags and Barcodes on each product.

Switching costs

The switching costs are very high at this point in time because the RFID readers are expensive at the same time the Barcode legacy systems have been embedded to every part of the retail industry. Almost every product has a barcode and there are 5 billion barcodes

scanned on a daily basis. It will be very difficult for enterprise of any size to make this shift in technology, more so when RFID is yet to be proven successfully in an FMCG scenario.

Differentiation

The need for differentiation is high as there are different products in the FMCG industry that need different kind of applications. For instance, perishable items would need tags that are time sensitive and some products might needs tags that are temperature, pressure sensitive etc. However for most products in the Gillette category (especially Razors) would require less differentiation.

Is it a Winner Take All (WTA) category?

This question needs to be dealt separately for the Tag side and the Reader side.

Form a Gillette standpoint, a successful implementation of RFID will take them to a WTA situation in the razor (and related) industry. This is because network effects are high, multi-homing costs are high and the need for differentiation is low. Thus being the first mover, Gillette can gain significant profitability through an optimized supply chain and by the time the competitor catches up, Gillette can provide competitive prices therefore capturing maximum market share.

Gillette is clearly not 'fighting' but 'sharing' the development of standards and the platform with other major players which makes the following conditions work for Gillette:

1. Maximum network effect on the market size
2. Market share will depend on marketing, external communications, positioning and distribution strengths

3. Higher margins in the beginning. The competition will be focused on price sooner or later thus plateauing the margins over time. However due to collaboration the combined market place can still manage to maintain high profitability.

However in case of Tag manufacturers, since the need for differentiation is HIGH along different silos of the FMCG industry there may not be a single winner take all for the whole of the RFID Tag or Reader category but there is likely to be a variety of verticals that offer specialized RFID features and within those verticals there could be a WTA situation. In any case there seems to be a significant WTA situation for a dominant platform - simple passive tags. All other platforms will be extensions or exclusives for which the user (retailer or supplier) is willing to pay a premium.

Envelopment

Clearly on the Tag side there is no envelopment possible as the manufacturers control that vertical. From a reader of software point of view there can be 'platform envelopment'. For instance, cell phone manufacturers can make cell phones that have inbuilt RFID readers and Contactless payment mechanism. This will enable the customer to read the tags and make payments to a credit card reader kind of Contactless machine. Such envelopment will attack the money side (reader side) of the network. Here Tag side represents the subsidy side as the suppliers cover the cost of the tag whereas the readers have to be purchased by the retailer. Similarly, Microsoft can bundle the RFID middleware with its enterprise contracts.

What does it mean for Wal-Mart?

Here's an estimate of what Wal-Mart might save annually when RFID technology is deployed throughout its operationsxli.

1. $6.7 Billion: Eliminating the need to have people scan bar codes on pallets and cases in the supply chain and on items in the store reduces labor costs by 15 percent.

2. $600 Million: Even with the most efficient supply chain on earth, Wal-Mart suffers out-of-stocks. The company boosts its bottom line by using smart shelves to monitor on-shelf availability.
3. $575 Million: Knowing where products are at all times makes it harder for employees to steal goods from warehouses. Scanning products automatically reduces administrative error and vendor fraud.
4. $300 Million: Better tracking of the more than 1 billion pallets and cases that move through its distribution centers each year produces significant savings.
5. $180 Million: Improved visibility of what products are in the supply chain-in its own distribution centers and its suppliers' warehouses-lets Wal-Mart reduce its inventory and the annual cost of carrying that inventory.
6. $8.35 Billion: Total pre-tax saving is higher than the total revenue of more than half the companies on the Fortune 500.

The impact of systemic variables in a dynamically changing environment that represents emerging technologies like RFID, is undoubtedly profound, as evident from the above analysis. It becomes therefore imperative that companies that wish to jump onto the bandwagon and adopt such technologies have some kind of tool that's gives then an objective visibility into the future as well as facilitate strategic planning and decision making. In the ensuing sections, the attempt is outlay the challenges surrounding forecasts in the RFID industry and to develop a tool for collaborative forecasting and strategic planning, which we call the PELOTON.

Section 4

The RFID Forecasting Challenge

The RFID industry is going through a sea of change and at different levels within the industry. We are at a critical juncture in the history of RFID where there is excitement among stakeholders and the technology's promise needs to be harnessed by providing the stakeholders with a clear idea of (a) where the technology's future lies and (b) how consensus on how to achieve such a future can be facilitated. To address the first issue we need to identify or develop a technology forecasting methodology that could capture inputs from all dimensions of the industry and lay down a range of possible future paths. To address the latter issue of collaboration, we need to identify the various stakeholders and their stages of adoption and provide a platform for people at a similar level of adoption to collaborate or enable those seeking information to be able to get into the bandwagon. We realized that there are three categories of people who influence the future of RFID: Retailers, Suppliers and Industry experts.

Both the above tasks are hard to fathom and the reason is that one we are taking about future which has uncertainty, bias, excitement, and interests, and the second is collaboration which involves competitive spirit, individual interests, motivations and incentives. There are methodologies available to assess the future of unidimensional aspects of technology but there seem to be a lack of techniques that could measure multidimensional elements of technology assessment. Some of the most common methods of technology forecasting are expert opinion, consumer surveys, cross-impact analysis, scenario planning, conjoint analysis, war gaming and so on.

As we will see in Section 5, on reviewing previous research we have found judgmental techniques such as the Delphi methodology are the most related to our goals and we felt a new approach may be developed to address the future assessment part of our challenge. In such section we will review judgmental forecasting methods and expose some of the

limitations of the existing approaches to address the RFID forecasting challenge as stated here.

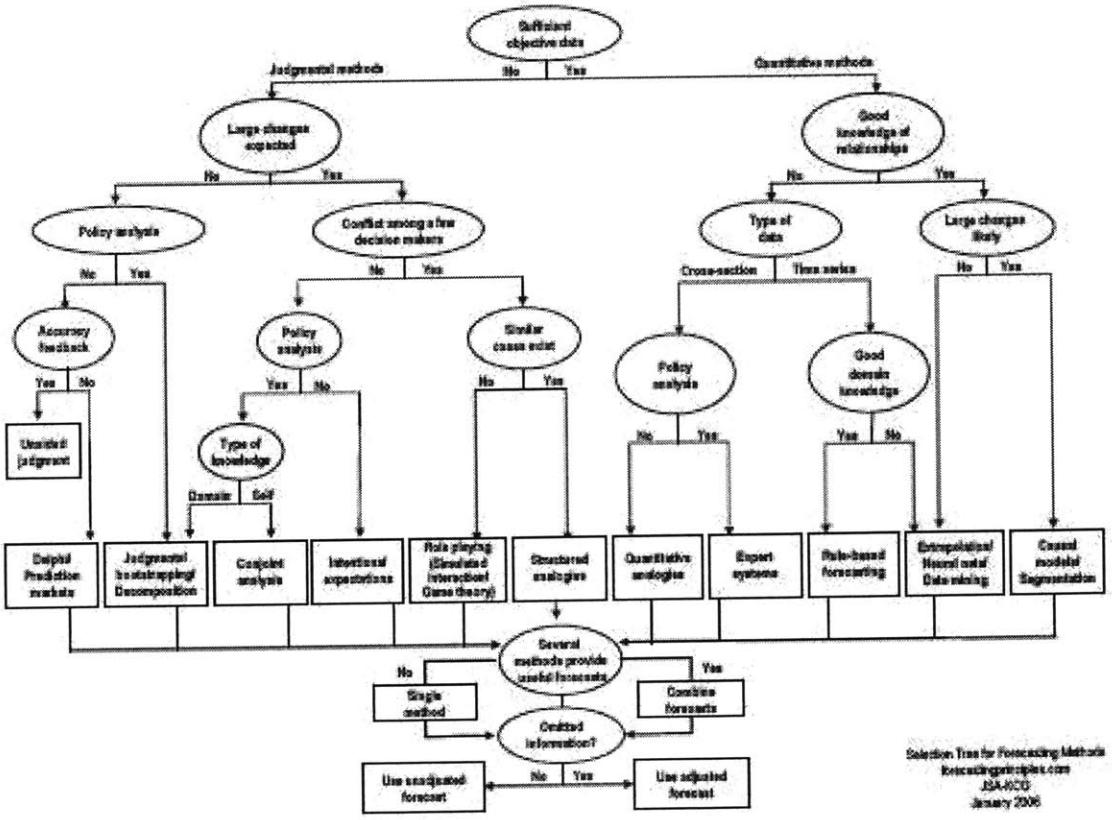
Forecasts have been done on different facets of the RFID/EPC industry like the market size or the possible financial returns. However, the forecasts to date are not based on a collective view on the evolving, dynamic and inter-relating nature of such technology.

Section 5

Review of Previous Work

As we embarked on finding the right forecasting technique, we reviewed several forecasting methods that have been used and developed in the past in order to assess the future of emerging technologies. Two factors are fundamental to choosing the right approach and they are: The forecasting tool selection and the methodology. A comprehensive Selection Tree and Methodology tree developed by J. Scott Armstrong helped us to move in a structured way to find the best approach and eliminate the rest.

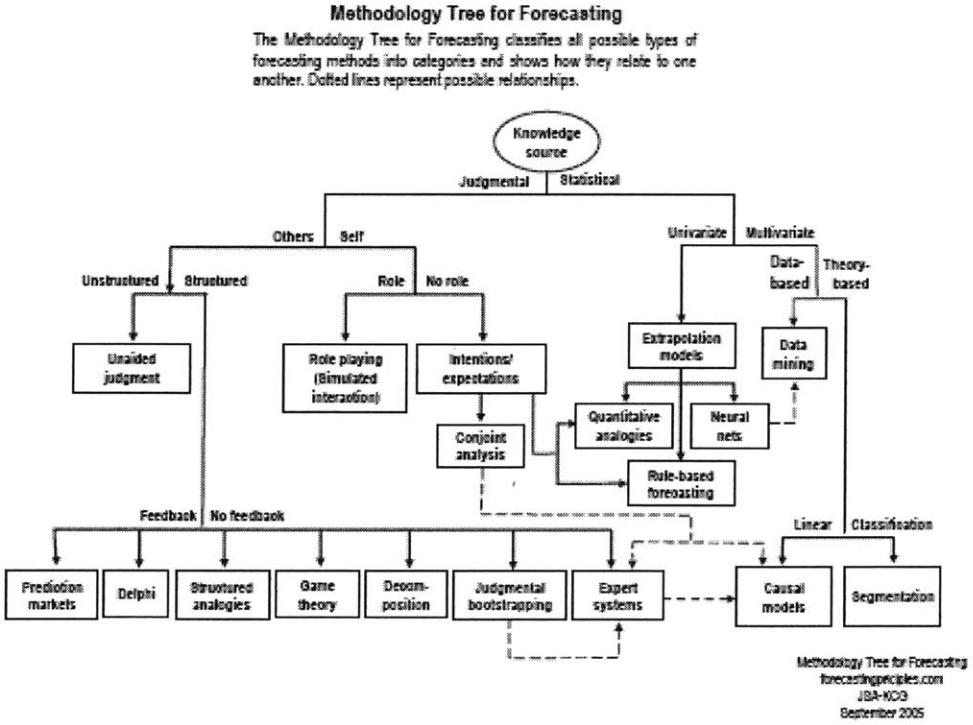
Figure 13: Selection Tree © 1997-2004 J Scott Armstrong



The current state of the RFID industry is where the industry respondents have limited accuracy of feedback, regulations/policies are not in place, we do not expect major changes yet there is conflict among decision makers and the lack of useful historical data on success cases leads us (based on Figure above) to the need for a forecasting technique that takes advantage of multiple tools like Delphi, Bootstrapping, analogies and some quantitative analysis. The Delphi technique as its backbone, the Peloton methodology attempts to optimize the inherent strengths of other tools and improves the reliability on the forecast around the RFID industry there by minimizing the vagueness created by the conditions of flux. In Scott Armstrong's terminology the Peloton may be akin to a combination and adjustment methodology.

We decided to test our hypothesis for the need of a modified forecasting approach with the Methodology Tree (Shown in Figure below). Clearly, we have a judgmental, semi-structured, semi-quantitative information source which indicates the need for a combined method.

Figure 14: Methodology Tree © 1997-2004 J Scott Armstrong



Since the Delphi technique forms the starting point of our work, we describe the same in detail below.

The Delphi Technique

The Delphi technique was first used in early 1960's by the Research and Development (Project RAND) for the US Air Force to predict the military potential of future technologies. The technique is largely a systematic and controlled communication method to get "experts" in a particular field to assess and express the future of a certain technology. Some of the successful forecasts, from the Report of a long-range forecasting study by Gordon and Helmer in 1964, include the development of oral contraceptives, artificial organs, X-ray lasers and synthetic proteins (Gordon T.J, 1994. This technique has been used in a number of fields for long-range planning- including healthcare (Peterson, 2003; Hudak, Brooke, Finstuen & Riley, 1993), marketing (Lunsford & Fussell, 1993), education (Olshfski & Joseph, 1991), information systems (Neiderman, Brancheau & Wetherbe, 1991), transportation and engineering (Saito & Sinha, 1991), international affairs, leisure activities and the like (McCampbell & Stewart, 1992).

Gordon and Hayward (1968) who claim that the Delphi method, based on the collation of expert judgment, suffers from the possibility that reactions between forecasted items may not be fully considered have developed an extension of Delphi, cross-impact analysis for such a situation [http://www.iit.edu/~it/delphi.html]. Over the years Delphi has been executed in other differently modified ways like Rotationally modified Delphi (Custer, Scarcella and Stewart), Imen-Delphi developed as a variant of Delphi to facilitate discussion among the group of panelists (Passig, 1993) and based on applied social systems theories (Bahg, 1990), Cross-Impact Analysis (Dalkey 1972) etc., but the essence of the Delphi method is an attempt to answer three key questions in a certain discipline:

1. What is the future going to be like?
2. Is it desirable and what could be the implications?
3. How are we going to get there?

Usually a Delphi coordinator communicates and compiles the questionnaires and responses respectively. The basic process for the Delphi method of forecasting includes the following steps:

Identification of Experts: Depending on the area of inquiry, panels of experts, decided through common knowledge, publications, references etc are contacted for support in the initiative to predict the future of say, a certain technology. Historically 10 -35 people have been identified with an acceptance range of 35-70% (Gordon and Helmer, 1964), though there seems to be a large variation in this.

Formulation of the Questionnaire: One of the most important elements of Delphi method is to have sufficient objectivity and subjectivity. Initially the questionnaire is sent out to a smaller group of experts who review the questionnaire for its relevance and correctness. Then the questionnaire is sent out to a larger group. Some of the important things to keep in mind are to avoid complicated questions, if possible provide choices, and avoid covering multiple elements of enquiry in one question.

Analysis of the Responses: The analysis is an iterative process. The questionnaire provides room for explaining strong opinions and disagreements. In such a case the coordinator has on-to-one discussion to understand the opinions in the right light. Once the clarifications are made statistical segregation of groups is done. To avoid single extreme answers from skewing the results, normally a median is taken more than the mean. Many times, analysis also show inter-quartile ranges (with greater than 50% respondents) (Rowe, and Wright 1999). The analysis of data includes three parts. The first part and main part of the Delphi process consisted of analyzing each item for consensus. For instance for a particular study, consensus was considered to have been achieved when an Interquartile Range score of less than 1.2 was obtained (Zeliff & Heldenbrand, 1993). A second component of the analysis was to evaluate the perceived importance of the items. To accomplish this, the six-point scale was evenly divided into high, medium, and low importance. Items were then classified into one of six categories based on an analysis of

consensus combined with importance (Custer, Scarcella and Stewart, 1999). The authors showed how this kind of categorization helped in faster consensus on major differences.

Final Evaluation: This is usually a presentation of trends and where the median consensus is, in terms of where the future of the technology or the field of enquiry is.

In fact, one of the judgmental forecasting studies closest to what our goals are is published by the Office for the Study of Automotive Transportation, University of Michigan Transportation Research Institute, Ann Arbor, Michigan,. In such study, the University of Michigan forecasted the US automotive industry through the year 2000. It covers three independent categories of respondents. Marketing, Technology Experts and Materials experts are independently surveyed in their corresponding three categories. The number of respondents for the automotive survey was 330. In many ways, the Retailer, Industry and Supplier respondents we have considered for the Peloton development questionnaire is similar to the above. However, the Peloton methodology we are developing attempts to carry out a technology forecast using multiple and correlated set of events and that is a fundamental difference from the Delphi method and other judgmental technologies reviewed.

From the textile industry in United Kingdom [Rodgers, 1980] to the Automobile industry in USA [OSAT, U.Mich, 1989], this technique has been used with a fair amount of success especially in technology forecasting. The outcome of a Delphi technique is nothing but a structured opinion. The are both pros and cons for the Delphi method.

Advantages of the Delphi Method

While different techniques, whether extrapolation, judgmental or other, have been used to forecast technology, the Delphi method seems to be the only one that has been proven with some degree of success. Studies comparing the Delphi's results with other methods (Ulschak, 1983) confirm the effectiveness of the method related to generating ideas and

use of participants' time. The lack of historical data in case of a new technology or application also makes it difficult to use a method like extrapolation. The fact that an attempt to predict the future is done presumably by experts who are catalysts for that change and are involved in the happening, gives Delphi the advantage of generating a range of opinions generally in the same direction making it a reality construct (Drictzcl, 1970). In most cases Delphi has been used to measure or predict one particular dimension of an issue (Keenan, 2003). One of the best things about Delphi is that it avoids any kind of emotional or other group dynamics affect the opinions due to the singularity and anonymity of respondents, thus providing a fair amount of objectivity to the responses. It is also useful for geographically disperse respondents (Adler and Ziglio 1996).

One of the best testimonies of expert based forecasting is provided in the book, Forecasting the Telephone-A retrospective Technology Assessment of the Telephone by Ithiel de Sola Pool (Pool, 1983). The book reviews over 100 forecasts made on the telephone and checks the validity of the forecasts from a retrospective effect. It goes on to say that 143 out of 186 predictions fit the model and most of these were done by people who understood the technology and sought to assess how to implement it in a way that would pay. Some of the best predictions were made by people like Graham Bell and Theodore Vail, who not only understood the technology but also contributed to the success of it.

Wherever there are differences of opinion, even if very strong ones, the coordinators get a chance to understand the perspective through multiple rounds. Inter Quartile Ranges (IQR) are used to uncover such differences in opinion making resulting in one of the major strengths of Delphi (Turoff. and Linstone, 2002). As the responses are anonymous and the panelists do not have the opportunity to 'perform' in the flesh, the threat of ego, domineering personalities, inhibitions, or various other subjective disruptions are avoided (Cunliffe, 2002). It is intended to "provide a general perspective on the future rather than a sharp picture" (Moeller, Shafer 1994). Also from a review of literature it has been found that after three rounds no significant information was gained thus saving money and time in complex cases (Altschuld, 1993). Salancik has examined the hypothesis that the panelists in a forecasting Delphi assimilate input on feasibility, benefits, and potential costs

of an event in an additive fashion to estimate its probable date of occurrence (Salancik,1973).

Disadvantages of the Delphi method

While it is true that Delphi has many advantages in forecasting about a field where there is not much substantial past data, there have been many critics of the approach too. Here we report just a sample of the possible drawbacks as reported in the literature. Critics believe that the selection of experts is a subjective thing and there could be lead users who are unknown but have a large influence over the future. The fact that Delphi takes all experts at the same level could lead to lack of a preferential weighting system in favor of some experts who have a greater ability to influence that change. Normally Delphi is not considered effective with questions on multiple and interrelated parameters and has been more successful with mono-variables (Keenan, 2003). It involves cooperation of experts, who are usually busy, for a timely and accurate and stable response (Helmer 1963). There are times when simple facts from historical data may differ from expert opinion resulting in incorrect judgmental calls. At the same time there are cases of unknown correctness (Remus, O'Connor , Griggs 1998). There is also a tendency for people to discount the future (Linstone, 1973) since people operate out of current memory. In the excitement to be creative in predicting the future people can go overboard. Often, there is an urge to simplify things which might seem complex which may be far from the real picture. Technologists have consistently underestimated the complexity and cost. Nearly 50% of military program have had a cost overrun of about 50% (Browne S H, 1971). Poor execution and analysis by the analyst or the coordinator can significantly affect the results and generate erroneous predictions. There is also misalignment in the understanding of time horizons (Coates, 1999). Many times there is an over-pessimism in long-range forecast and over-optimism in short range forecasts (Bushmann 1969). Other related issues reported in the literature include overselling and deception from real thoughts which are very difficult to measure or find out (Cyphert and Gant, 1970). Competition and issues of propriety may lead to responses which are incomplete or different from actual. Sometimes

due to repetitive nature Delphi quickly reaches a point of diminishing returns (Goodman, 1970). The American Statistical Association in 1971 describes the Delphi technique as the antithesis of scientific forecasting and of questionable practical credibility (Welty, 1971). The problem of representing uncertainty in precise terms is closely related to past attempts to translate lack of information into probabilities by means of principles such as the "law of insufficient reason," or the rule of equal ignorance. These have invariably lead to paradoxes (Reichenbach, 1949)

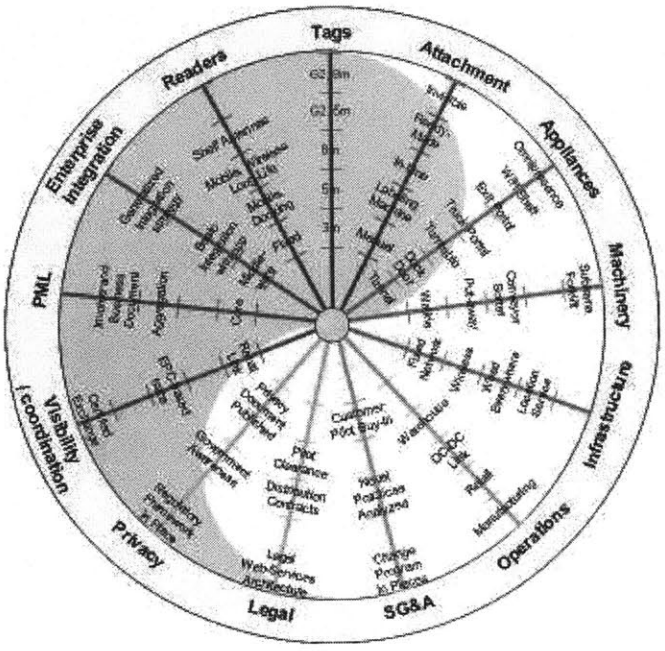
Section 6

The Peloton Forecasting Methodology

As our analysis of the RFID industry requires capturing information from multiple levels of stakeholders on issues, events and sectors that are multidimensional in nature, we are not in a position to use Delphi or any of its existing variants in its current form. However, through the review of previous work our research lead us to develop a novel forecasting tool to gather and analyze opinion for a multidimensional forecast. In the ensuing paragraphs, we show the development of the Peloton tool and the visual representation around it.

The EPC/RFID Peloton

The diagram shown next, one of the initial representations, illustrates the categories where different players of the RFID/EPC Peloton are centered and how each category may evolve over time.



The above visual representation resulted from a series of iterations at expressing the various aspects of the RFID/EPC Global. Below is a sequence of diagrams that illustrate what are the requirements for a FMCPG manufacturer at different steps in the implementation of an RFID/EPC solution going from a simple pilot, through a within the four walls application to a full blown test with a customer. The diagram is designed to visually illustrate the interrelationships mentioned at the beginning of this extended abstract. The diagrams below attempt to represent the various steps required to achieve certain milestones around different vectors like Tags, readers, etc. The connected star like figure in the centre links the current stages of development. The limitation of the initial models were that the time horizon was not amply represented.

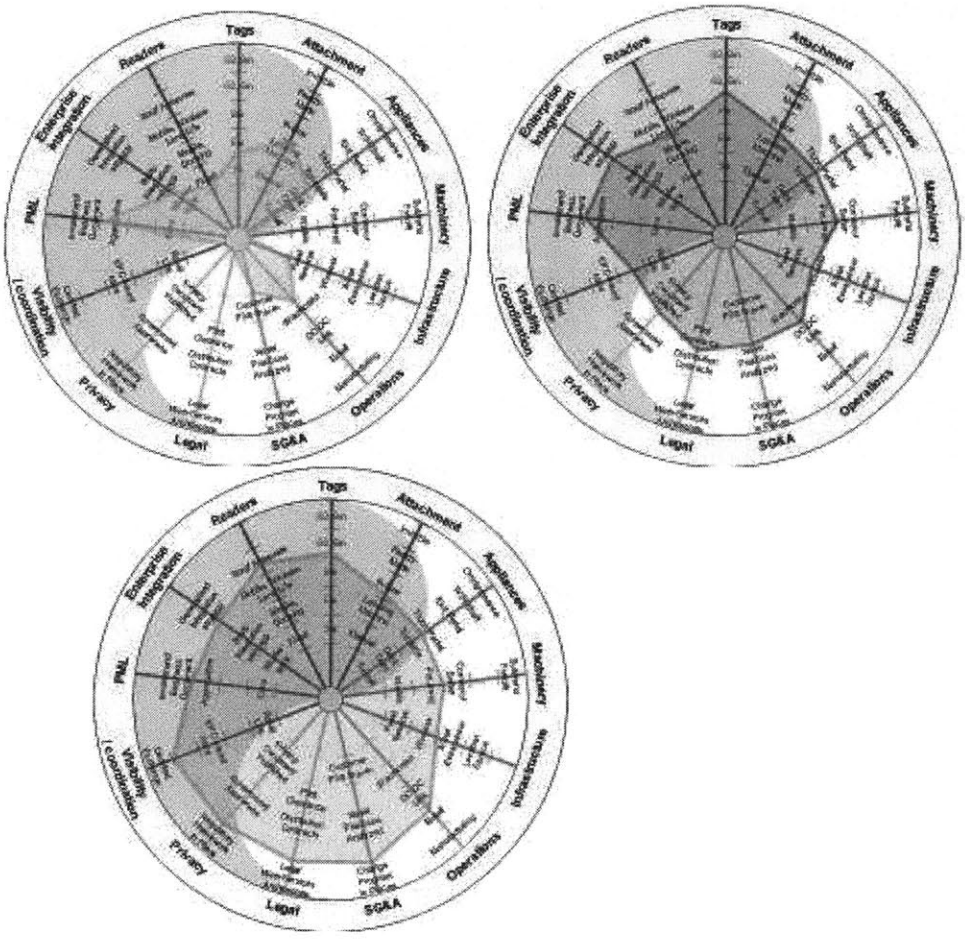


Figure 15: Initial Development of Peloton

Work on the Delphi Peloton Methodology

The first step was to create the diagrams above with the input of just a few players. We then assembled a Project Management team comprising of people from the MIT Auto-ID lab, RFID/EPC experts from industry and from the EPC Global team.

Our first set of discussions started of with a business session where over 60 key stakeholders in the RFID industry participated in a two-day workshop to identify the key issues that govern the industry's outlook for the future. One of the best discoveries was that such competing and diverse group was willing to collaborate to make the RFID endeavor a success. In many was, all the stakeholders (including competitors) recognized the need for collaboration. Based on the workshop inputs and literature form the past and several rounds of discussions we developed a draft questionnaire that would enable us to capture the key events that would play a significant role in shaping the future of RFID industry. As a result from this first round, a preliminary version of the Vectors and Events where identified. Vectors represented the fundamental components in the RFID/EPC industry that had both magnitude and direction and lasted long. The Events reflected the key happenings at certain points in time (along each of the vectors) that the 'experts' would consider to have a substantial impact in steering the progress and defining the future. The forecasting management team reviewed the questionnaires which were differentiated for three categories of respondents, Retailers, Industry and Suppliers.

As the next step, we identified a lead member for each vector, selected based on their leadership position (not necessarily title) in that particular area of the vector. One round of answers from about 10 vector leads was received. Individual discussion was conducted with most of them to understand comprehension of the questionnaire as well as the vectors and events. The data was collected from all vector leads and the questionnaire was refined for the second round.

Identification of Systemic Variables (Vectors)

As mentioned earlier, we considered the split of respondents under three main categories as relevant segmentation. Retailers who represented the front end of the business, for instance departmental stores like Wal-Mart; Suppliers who formed the back end of the business, like Gillette who supplied products to the retailers, and finally Industry experts, like people who were into developing technologies, software, consulting etc.

Industry: This category of experts would primarily focus on the broad issues that concern the industry and how they think things will shape up under various areas of RFID.
The vectors under the industry sector are:

- Tags
- Readers
- Applications
- Security
- Infrastructure/Network Standards
- Legal/Privacy/Public/Policy/Regulatory
- Service Providers

The vectors under the Retailer sector are:

- Retailer pilot adoption
- Retailer DC infrastructure
- Retail store infrastructure
- Business Processes

The Supplier vectors are:

- Supplier Sources
- Supplier DC infrastructure
- Business Processes

A forecaster has to keep an eye on all the events which differ from country to country, but have an impact on the forecasts (Reese 2003). Incidentally we realized the dynamics of adoption in Europe and US were different. Regulatory issues were taking the European concerns to a different level. This led us to a decision to have different round of questionnaires for Europe and the US.

Significant emphasis was also given to the format and convenience for both responding and analyzing the responses. These updated questionnaires were sent out to the identified experts in USA. Through discussion we have attempted to eliminate the two common sources of process inefficiencies - political and inappropriate optimism (Galliard, Michael, 2003) which are:

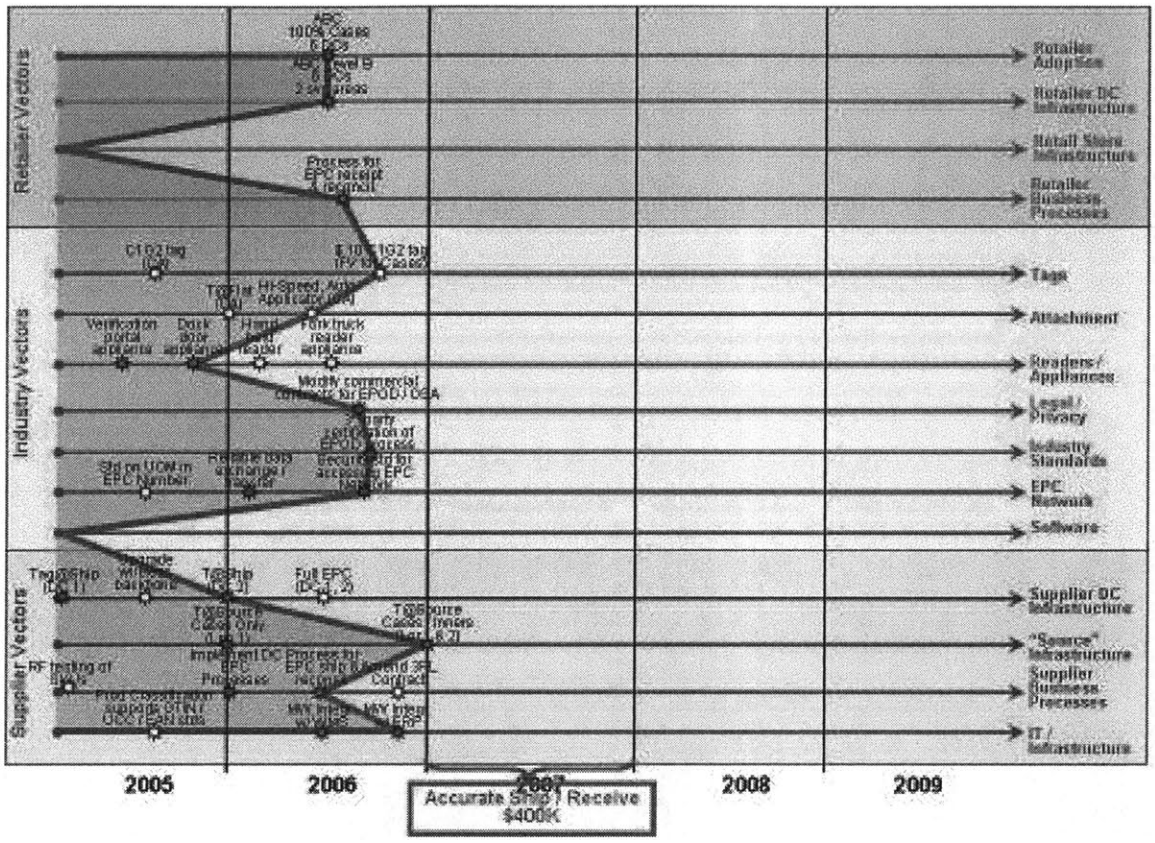
1. Confusing management's targets or wishes with an "unbiased best guess" of what demand is really going to be (By prompting specific target dates).
2. Spending excessive resources to achieve levels of accuracy, unreasonable to expect, given the nature of demand being forecasted (by providing broad time horizons).

To integrate judgment into quantitative models, Bunn and Wright (1991) identify four gateways: variable selection (where judgment seems to be useful), model specification (where there are conflicting beliefs among the schools of forecasting researchers), parameter estimation (where promising theoretical results have failed to improve practice), and data analysis (which remains heavily judgmental and poses challenges for researchers).

We have clearly seen that in an emerging technology, variable selection is a key ingredient, variation in responses present some conflicting timelines, past theoretical predictions on the adoption of RFID has not been accurate and limited availability of useful data poses challenges to statistically significant analysis. This creates an appropriate platform for the Peloton Approach.

After several rounds of expert user meetings, we finalized the vectors listed above and developed a visual representation that could indicate the timelines in a more useful manner.

Figure 16: An illustration of the new Peloton diagram in the making.



Over several iterations the Peloton diagram now incorporates several new and significant events that arose as our discussions with the partners of EPCGlobal. The below figure indicates the latest version. The beauty of the Peloton is also its ability to take in new events as the emerging technology unfolds.

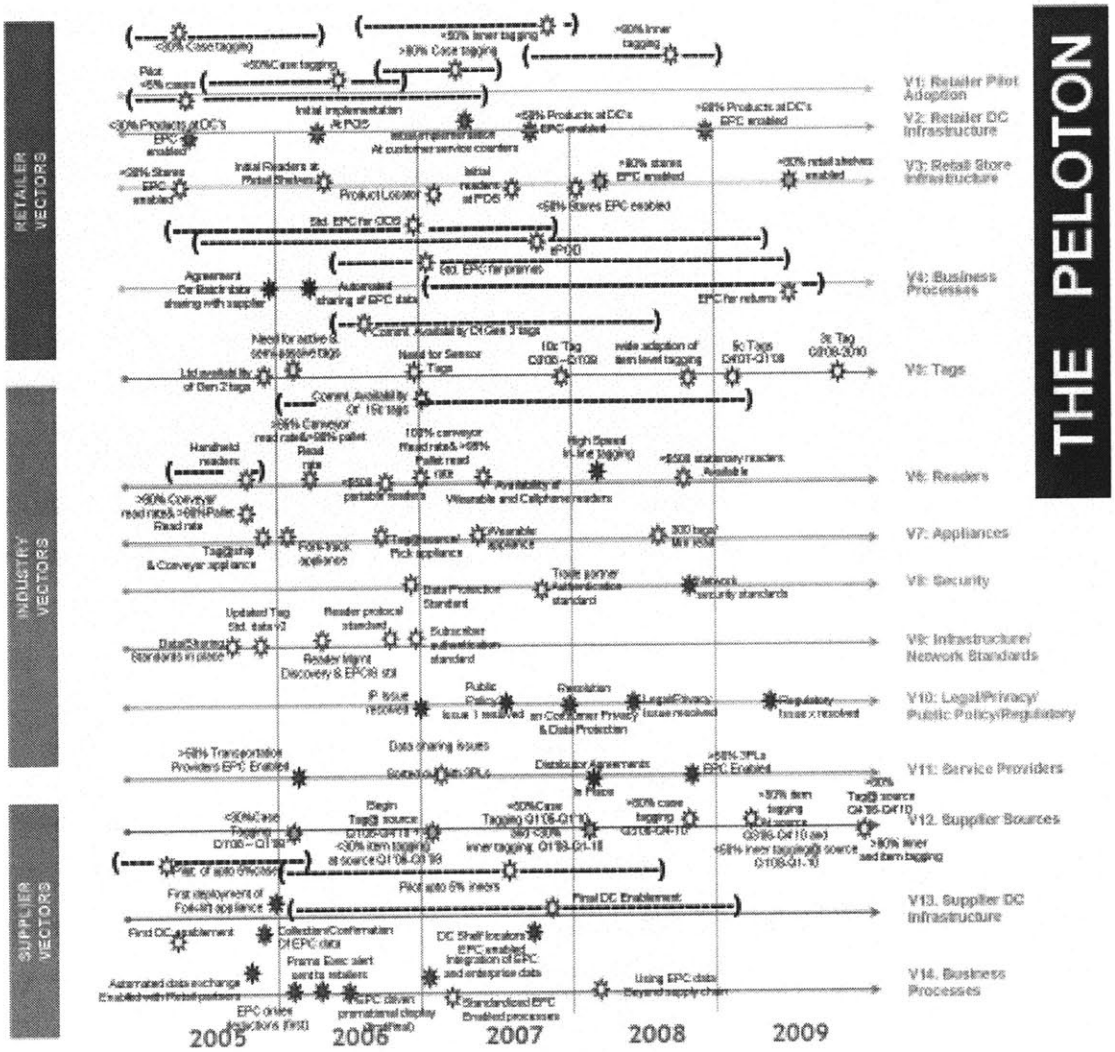


Figure 17: Final Peloton

Section 7

Peloton as a Strategic Planning tool

Using the Peloton to Evaluate Business Benefit

The following provides an example of how the Peloton can be used to understand the timing surrounding when a business benefit can be achieved. For this example the Peloton will be used to evaluate when "Suppliers / Retailers can expect EPC technology to assist in producing Promotional execution and New Products Introduction benefits". It shows that four key events need to be in place for "Promos" to be executed effectively. (See Fig. below)

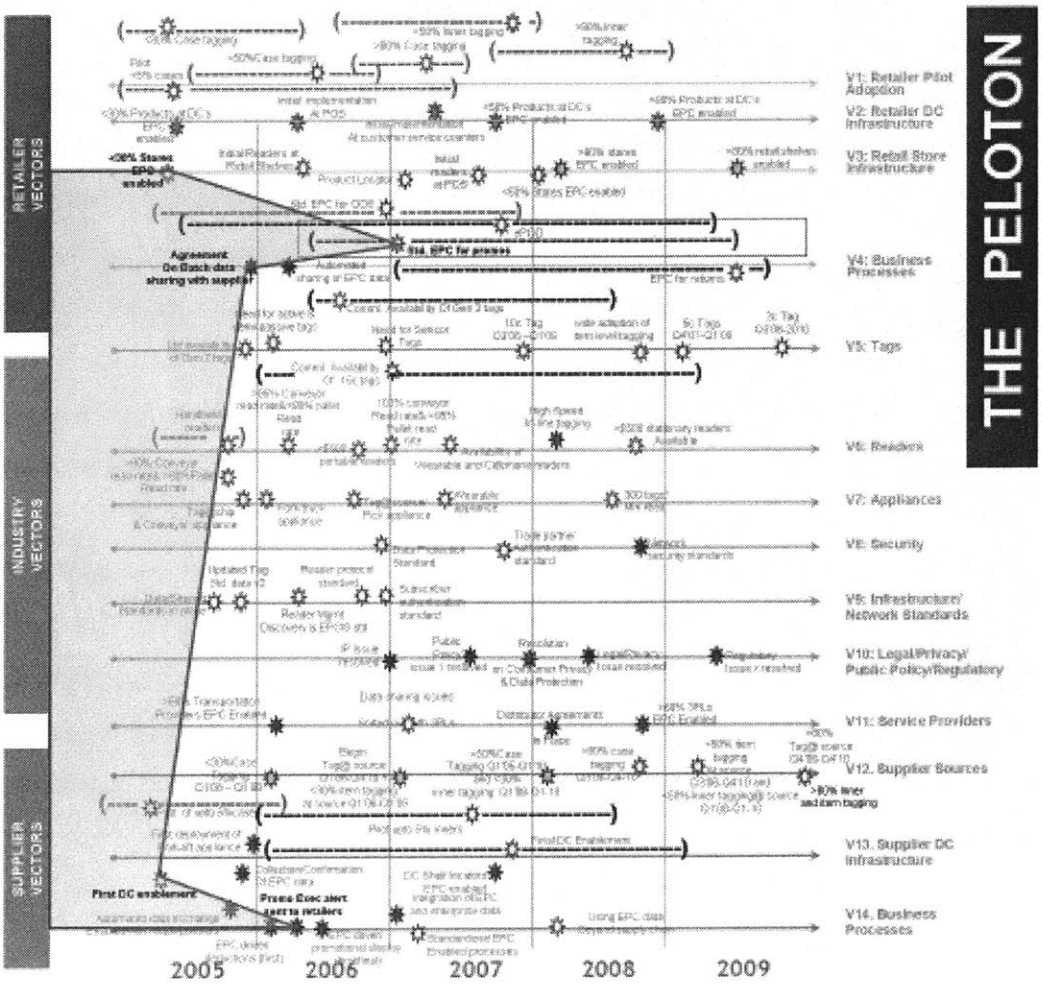


Figure 18: Peloton for Promotional Execution

The way to understand the key events for executing promotional execution is that: For promotional execution at the retail level the following events need to be in place (end nodes above from top to bottom):

For the implementation of promotional execution, anywhere up to 30% Retailer stores EPC-enablement is all that is required on the Retail store infrastructure vector; which means visibility of Promotional Displays received at the back room and moved to the selling floor. The stars indicate the median response, which is intended to indicate that mid of 2005 is the most represented timeline by the retailers for completion of this step. Use of standard EPC for promos, as a business process (standard operating procedures) needs to be in place at the retailer level. The median timeline response indicated that this would be done by early 2007.

Retailer sharing of Store EPC read data with Suppliers tagging Promotional Displays have to fall in place. With this information, Suppliers can work with specific Retail Store managers or their internal Retail Operations to focus efforts on Stores where displays appear to remain in the backroom.

First DC enablement, indicating that just an initial DC readiness at the Supplier DC's is needed. The fact the currently most of them at tag@ship shows that there is no need for any high tech provisions but a manual intervention (tagging) should be sufficient for most suppliers to apply EPC tags to promotional displays. This event, as per the median of response timelines has also been completed by mid 2005.

At the supplier business process level, a trigger needs to be initiated to alert promotional execution to the relevant retailers. The suppliers are likely to be ready to execute this by Q2 of 2006.

By "connecting the dots" of the related vector events, we create a quick visual analysis. The connected events indicate that retailer business process readiness in terms of the use

of standard EPC for promos in mid 2007 is the critical event that should enable both suppliers and retailers to benefit from EPC tagging of promotional displays. As we have seen within the industry, there are many companies that are seeing benefits in 2005 and so 2007 may even be a conservative timeframe. A simpler inference of the above Peloton indicates that near term promotional execution improvements can be achieved with a relatively low level investment in EPC technology.

Suppliers (or their third party packagers) need only a means to tag promotional cases/displays. For many instances this tagging can be performed manually "Slap and ship". Suppliers need to capture the data from all shipped promotional items. Suppliers also need access to EPC reads from the Retailers EPC network. Once the supplier has both their own reads and the retail reads they can use a simple spreadsheet to track location of promotional items and make determinations of where the promotional items are in the supply chain.

Retailers need read points at their distribution center and store locations. These read points need to provide at a minimum the location of the promotional item at the DC, the store backroom, and the store sales floor. Retailers need to make this EPC information available to suppliers.

Similarly, various inter-linking of the events for different industries, product categories and business model are possible.

Important

The Peloton is only a strategic planning tool and the timelines are median of all the responses. The ranges and confidence intervals for expected timelines for each of the events vary, so while using these timelines for planning and investments companies should consider the contextual references pertaining to the specific industry.

EVENT COLOR LEGEND	
White	Event as in the questionnaire
Orange	Events that are in initial adoption stage
Blue	Events that are in final stages
Red	Events that were not responded to/provided specific timelines, but we have retained
(------)	In Parenthesis indicate range of responses

Section 8

Conclusion

Decision-Makers rated implementation-related criteria as the dominant feature they required in a forecasting method (Yokum & Armstrong, 1995) and the Peloton attempts to help the decision makers get an snapshot of the industry in a single glance. One of the greatest limitations of a collaborative movement is the difficulty of clear leadership due to the need for swiftly compiling diverse and multi-dimensional inputs to present the trend ahead and show a structured path for decision making and calculated risk-taking.

The Peloton is a dynamic tool and it allows itself to be modified to include the latest input to show trends around an emerging technology such as EPC/RFID. In this world of coopetition, the pertinence of a system that allows collaboration is the standard setting process is inevitable. The faster we are able to set the standards in an emerging industry, the faster can the market grow and the players benefit from the pie.

The Peloton methodology can be easily modified to aid collaboration in other industries where the technology is emerging and the standard setting process needs to be expedited.

Section 9

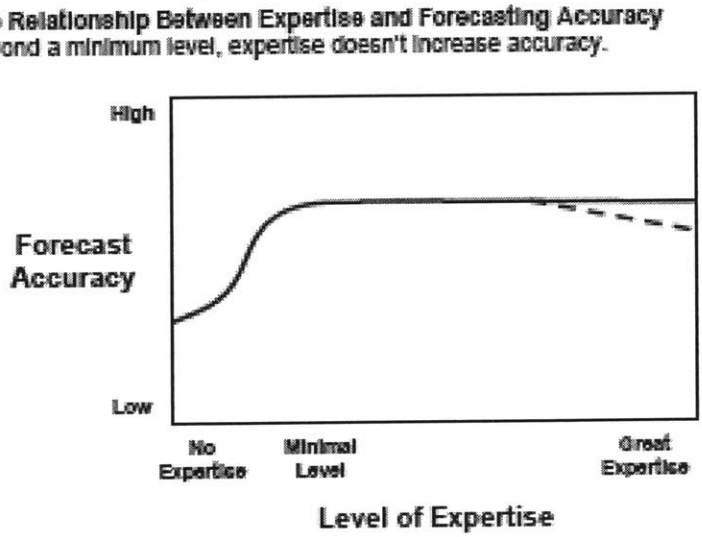
Next Steps

Web Enablement

The initial Peloton was build by personally corresponding and manually calculating the median timelines. As the number of experts increase, the technology incrementally changes, and the business landscape transforms, for us to make the Peloton continually relevant, we have started the process of making a web-enabled Peloton where continuous input is taken in and periodic output is given out.

In fact, dozens of carefully constructed studies have demonstrated that expertise beyond a minimal level is of little value in forecasting change (Armstrong, 1981; ses figure below). And so we have decided to let most of the EPC Global members who are in some from or the other involved with RFID implementation in the initial stages participate in providing inputs to the Peloton.

Figure 19: Relationship Between Expertise and Accuracy



We hope to unveil the web-enabled Peloton by Aug 2006.

The European Peloton

The success and usefulness of the Peloton within the US EPC community has spurred the need for a similar exercise for the EPC European partners and such an initiative is currently ongoing. A glimpse of the initial EU Peloton is shown below.

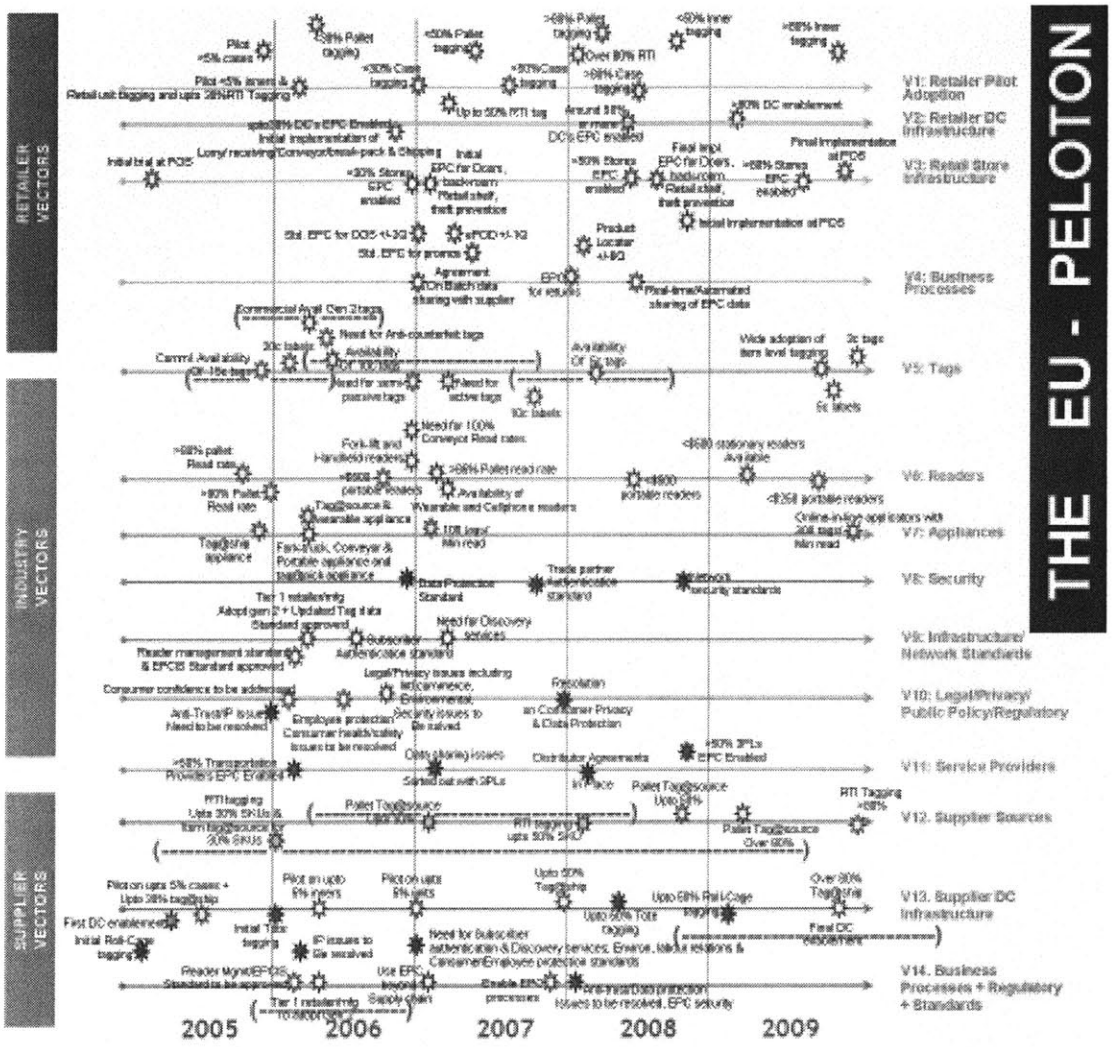


Figure 20: European Peloton

As the Peloton unfolds and provides a platform for global coopetition, we are sure we will see a new dynamic in the 'standard setting process' for emerging technologies.

The HLS Peloton

The success and the widespread use of the Peloton in the FMCG sector has fuelled the motivation and need for a similar exercise in the Health and Life Sciences (HLS) sector. As a write this thesis, work is being done to develop a web enabled Peloton for the HLS group.

MY DREAM PELOTON

The ultimate Peloton will be one which is run by software that enables moderated data capture from different parts of the world and produces demand driven segmented industry specific information that is relevant to users without creating a cloud of information. The work in that direction has already begun and the success of the web enabled Peloton will be a stepping stone to that end.

A step beyond that will be the Peloton and the RFID Value calculator working hand in hand to generate 'decision enabling' reports for companies and users covering factors around industry readiness, critical path, investment strategies, staged adoption processes and so on.

Section 10

Emerging State of the RFID Industry

Jan 6, 2003: Alien confirms the 500m order from Gillette

October 1, 2003: EPC Global Launched

Auto-ID's technology was licensed to the Uniform Code Council in 2003, and they created EPC Global, as a joint venture with EAN International, to commercialize EPC technology. The Auto-ID Center closed its doors in October 2003, and its research responsibilities were passed on to Auto-ID Labs and at that time they had over 100 members which initially started as a four member organization. In November 2003, Cantwell was elected as the Chairman of EPC Global. Under his stewardship EPC global by 2006 has grown into an 800 plus member global standards setting body paving way for setting the de facto standards for RFID.

June 11, 2003: Walmart Mandate

Walmart CIO Linda Dillman, looking at the potential for RFID technology released a mandate that by January 2005, all the top 100 suppliers should tag their products with RFID tags carrying EPC codes. The suppliers were also required to install readers in their facilities along the supply chain. This move was greatly appreciated by several players in the industry as a significant milestone in the adoption acceleration process and many suppliers complained that they could not see value for themselves.

November 15, 2004: FDA Regulation

The Food and Drug Administration (FDA) today stepped up its efforts to improve the safety and security of the nation's drug supply through the use of radio frequency identification (RFID) technology.xlii

December 2004: EPCglobal ratified a second-generation standard, **EPC Gen2** in collaboration with ISO, paving the way for broad adoption and significantly lowering the standards imbroglio.

September 2005: P&G acquires Gillette and for the combined company Cantwell and his team have developed a new strategy by identifying three kinds of products (see Exhibit):

EPC Advantaged products: Those products onto which RFID tags can implemented immediately and ROI achieved.

Tested: The products which have been tested and have the potential to be tagged in near future subject to development of network effects.

Challenged: This represents the products which do not seem to have a clear ROI in near time future.

October 2005: Peloton first round completed for the US FMCG industry and unveiled to EPC Global members. Becomes highly successful and request comes in to expedite the European Peloton and subsequently the Peloton for the Pharmaceutical Industry.

March 2006: European Peloton first draft unveiled to select members of EPC Global for review and some tweaking continues.

April 2006: Work on the Pharma Peloton moves into full steam

Section 11

Author

Vineet Thuvara is a graduate student pursuing a joint master's degree in management and engineering at MIT/Sloan. Vineet has been working on his internship and his thesis in the area of RFID in collaboration with MIT Auto-ID labs, EPC Global and Gillette Corporations (Now P&G). He also cross-registered with Harvard Business School for the course- Managing Networked Businesses and his term paper has been a draft case on the network effects of RFID and the impact of Gillette. His business research interests include RFID, industrial design, visual communication and product management. Vineet can be reached at +1.732.718.8187, email: vineet.thuvara@sloan.mit.edu

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Sanjay Sarma is an Associate Professor of Mechanical Engineering and the Chairman of Research and Co-founder of the Auto-ID center at MIT. His research interests include RFID systems and embedded computing in general, computer sided design and computational geometry, machines and manufacturing. Sanjay Sarma can be reached at +1.617.253.1925, email: sesarma@mit.edu

Section 12

Acknowledgements

People who made the difference

Without the support of EPC Global members, in particular Gillette, this work would not have been possible, especially their edits, crits, inputs.... The world class people at MIT Auto-ID labs made a big difference to the way think.

My sincere thanks to:

Chris Ferguson (MIT), Dick Cantwell (Gillette/P&G), Jamshed Dubash (Gillette/P&G), Richard Lee (Gillette/P&G), James Supple (formerly with Gillette/P&G), Gay Whitney (EPC Global), Nicholas Fergusson (EPC Global), Abel Sanchez (MIT), Ching-Huei (MIT), Prof. Thomas Eisenmann (Harvard Business School), Pat Hale (Director, SDM Program)

Sponsors
Money is green and it talks. But rarely do people who have money have intelligence. My sponsors have always been directly or directly supporting this work and kept it going through thier passion & intelligence and will keep it going long after I leave MIT.

Special Thanks to:

MIT Auto-ID labs, Cambridge MA
Gillette Corporation (Now Proctor and Gamble),
EPC Global,
IESE Business School, Barcelona, Spain

Questionnaire Respondents and EPC Members
For your time, some lively discussions at various meetings, conferences and some of our weekly Peloton Review Meetings...

There were almost over a 100 people who have touched this project, with their responses, critiques and valuable advices. They have represented a wide array of sectors...from the several fortune-500 to few start-ups to top tier consulting firms and entrepreneurs in the RFID space. It is difficult for me to include the names because I am sure I will miss some and so I am not attempting to do it. My gratitude to each person who has directly or indirectly contributed to this effort.

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Section 13: Appendix

1. Questionnaires

1.1 Questionnaires: Industry Version

PELOTON QUESTIONNAIRE - INDUSTRY VERSION

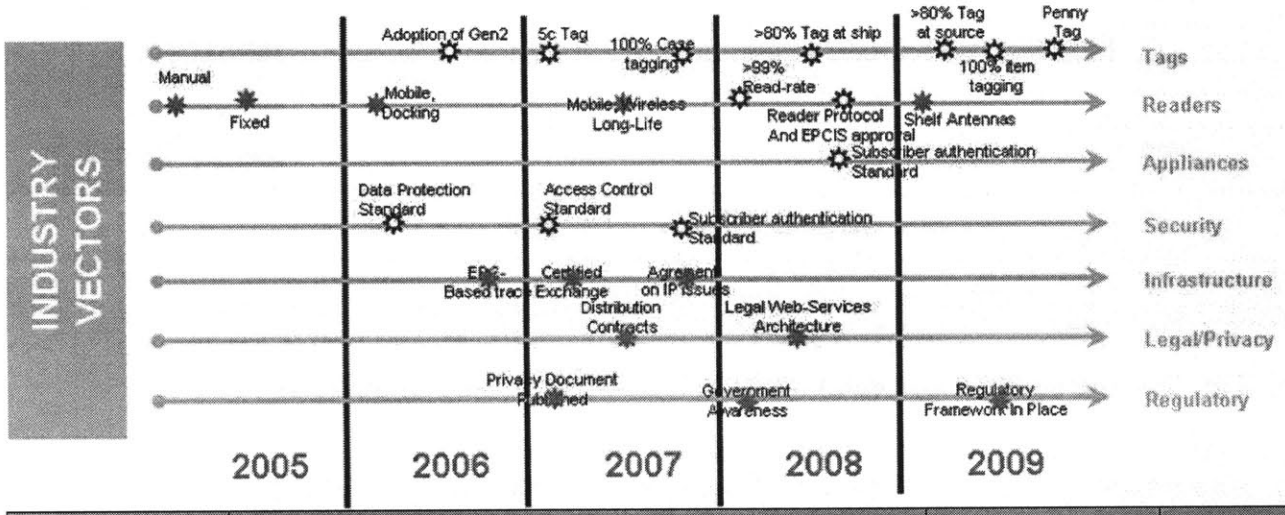
Thank you in advance for your time and support on the Peloton development and planning process. We request that you complete the questionnaire below in as much detail as possible, **by Wednesday, June 14, 2005**. You may also want to refer to the attached document (Summary of Peloton) for additional context. NOTE: This is a very preliminary document, on which we hope to expand upon using your responses to this questionnaire. Please direct any questions to Vineet Thuvara at MIT (vineet.thuvara@sloan.mit.edu or call 617-577-5634).

NOTE: IF THERE IS ANY CONFIDENTIAL INFORMATION YOU ARE PROVIDING, PLEASE LET US KNOW.

PLEASE BEGIN ANSWERING THE QUESTIONNAIRE BY PROVIDING YOUR CONTACT DETAILS .

Contact Name	
Title	
Company	
Phone	
email ID	
Location	
What's the best time and number to call you, if need be	

In the below grid please provide the targetted timelines in your company/industry. Our intent is to get an orientation towards the timelines that your company has decided. For your reference, the vectors along which the questions are asked are shown below.



VECTOR	EVENT	LEVEL	QUARTER	YEAR	ADDITIONAL COMMENTS
Tags	When do you think the cost of tags will be	10 cents			
		5 cents			
		a Penny			
	Tag at ship	less than 30%			
		50%			
		more than 80%			
	Tag at source	less than 30%			
		50%			
		more than 80%			

VECTOR	EVENT	LEVEL	QUARTER	YEAR	ADDITIONAL COMMENTS
	Case tagged	less than 30%			
		50%			
		more than 80%			
	Inner tagged	less than 30%			
		50%			
		more than 80%			
	Item tagged	less than 30%			
		50%			
		more than 80%			
	Retail stores enabled	less than 30%			
		50%			
		more than 80%			
	When do you think Gen2 will be adopted				
Readers	When do you think the read-rate will be	90%			
		95%			
		99% +			
Appliances	What is the level of availability of appliances critical to success	less than 30%			
		50%			
		more than 80%			
Standards	When do you anticipate widespread adoption of the Gen 2 Standard?				
	When do you anticipate the need for the updated Tag Data Standard to be approved and ratified?				

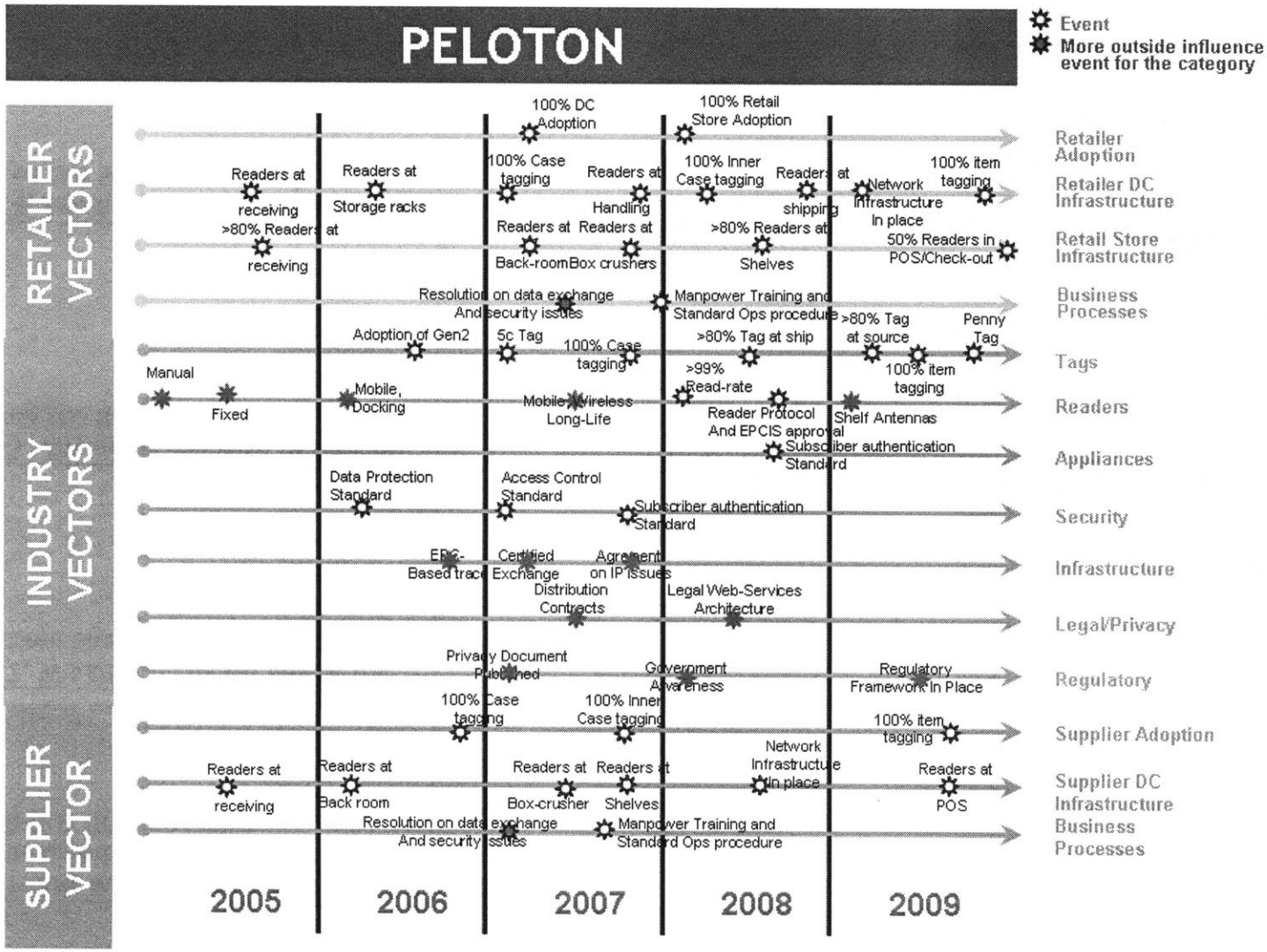
VECTOR	EVENT	LEVEL	QUARTER	YEAR	ADDITIONAL COMMENTS
	When do you anticipate the need for the Reader protocol Standard to be approved and ratified?				
	When do you anticipate the need for the Reader Management Standard to be approved and ratified?				
	When do you anticipate the need for the EPCIS Standard to be approved and ratified?				
	Do you anticipate a need for Discovery Services and when would a standard be required?				
	Do you anticipate a need for Subscriber Authetication and when would a standard be required?				
Security	What you use to authenticate people (eg. Drivers license, passport etc)				
	What kind of access control mechanism do you have in place?				
	How do you ensure data protection?				
	Do you see a need for federated (shared) identity management between EPCglobal subscribers?"				
Network Security	Do you feel that there is a need for a standard approach for authentication? When will it be required?				please key in here

VECTOR	EVENT	LEVEL	QUARTER	YEAR	ADDITIONAL COMMENTS
	Do you feel that there is a need for a standard approach for access control? When will it be required?	please key in here			
	How do you ensure data protection?	please key in here			
Public Policy	List any legal/privacy issues you anticipate as roadblocks and when they need to be resolved	Please fill here			
	List any regulatory issues you anticipate as roadblocks and when they need to be resolved	Please fill here			
	What timeframe do you see public policy issues no longer effecting RFID implementation				
IP	What are you biggest IP related issues? Please provide suggestions To mitigate those issues.				
Public Policy	Any legal/privacy issues you foresee?				
	Any regulatory issues you forsee?				
	What timeframe do you see public policy issues no longer effecting RFID implementation				

VECTOR	EVENT	LEVEL	QUARTER	YEAR	ADDITIONAL COMMENTS
What percentage of success of RFID do you attribute to		a. tag cost reduction			
		b. added value in supply chain			
General Pricing	What pricing do you think will support	a. Case tagging			
		b. inner tgging			
		c. unit tagging			
Geography	Which are the top 4 areas you wish to cover (Eg.Texas and central states, East Coast etc)		1		
			2		
			3		
			4		
Concerns	What are the top 5 concern areas in RFID implementation *(Please provide a quarter and year for these to be resolved)*	1			Please describe any issues you foresee in terms on new/alternate technology
		2			
		3			
		4			
		5			
What is the level of top management commitment on the RFID strategy (Use 1-for High, 2-for Medium and 3-for Low)					

Any other aspect of the RFID implementation strategy you wish to share with us?

Please answer the two questions that follow the Peloton in the next page:


PELOTON
Event
More outside influence event for the category
RETAILER VECTORS
INDUSTRY VECTORS
SUPPLIER VECTOR
100% DC Adoption
100% Retail Store Adoption
Retailer Adoption
Readers at receiving
Readers at Storage racks
100% Case tagging
Readers at Handling
100% Inner Case tagging
Readers at shipping
Network Infrastructure In place
100% item tagging
Retailer DC Infrastructure
>80% Readers at receiving
Readers at Back-room
Readers at Box crushers
>80% Readers at Shelves
50% Readers in POS/Check-out
Retail Store Infrastructure
Resolution on data exchange And security issues
Manpower Training and Standard Ops procedure
Business Processes
Adoption of Gen2
5c Tag
100% Case tagging
>80% Tag at ship
>80% Tag at source
Penny Tag
Tags
Manual
Fixed
Mobile, Docking
Mobile, Wireless Long-Life
>99% Read-rate
Reader Protocol And EPCIS approval
Shelf Antennas
100% item tagging
Readers
Subscriber authentication Standard
Appliances
Data Protection Standard
Access Control Standard
Subscriber authentication Standard
Security
EPC-Based trace
Certified Exchange
Agreement on IP issues
Distribution Contracts
Legal Web-Services Architecture
Infrastructure
Legal/Privacy
Privacy Document Published
Government Awareness
Regulatory Framework In Place
Regulatory
100% Case tagging
100% Inner Case tagging
100% item tagging
Supplier Adoption
Readers at receiving
Readers at Back room
Readers at Box-crusher
Readers at Shelves
Network Infrastructure In place
Readers at POS
Supplier DC Infrastructure
Resolution on data exchange And security issues
Manpower Training and Standard Ops procedure
Business Processes
2005
2006
2007
2008
2009

1. Any event you think is not included in the Peloton in the INDUSTRY VECTORS?	
2. Would you change any of the time lines?	
3. Any input you wish to provide on the Retailer Vectors?	
4. Any input you wish to provide on the Supplier Vectors?	

1.2 Questionnaires: Retailer Version

PELOTON QUESTIONNAIRE – RETAILER/DISTRIBUTOR VERSION

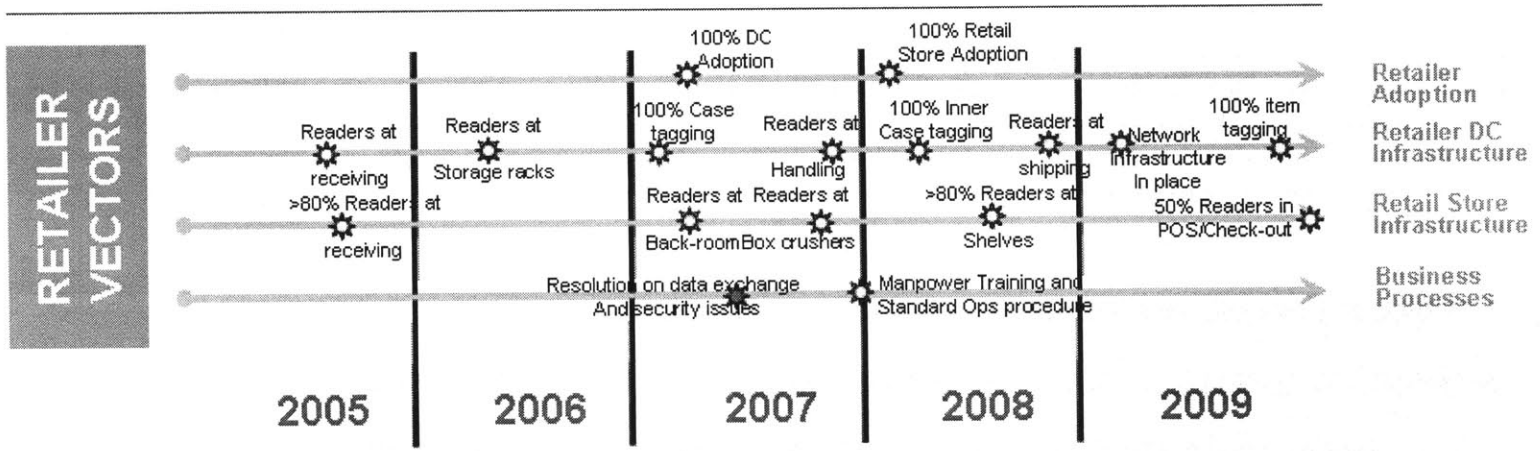
Thank you in advance for your time and support on the Peloton development and planning process. We request that you complete the questionnaire below in as much detail as possible, **by Wednesday, June 14, 2005**. You may also want to refer to the attached document (Summary of Peloton) for additional context. NOTE: This is a very preliminary document, on which we hope to expand upon using your responses to this questionnaire. Please direct any questions to Vineet Thuvara at MIT (vthuvar.thuvara@sloan.mit.edu or call 617-577-5634).

NOTE: IF THERE IS ANY CONFIDENTIAL INFORMATION YOU ARE PROVIDING, PLEASE LET US KNOW.

PLEASE BEGIN ANSWERING THE QUESTIONNAIRE BY PROVIDING YOUR CONTACT DETAILS .

Contact Name	
Title	
Company	
Phone	
email ID	
Location	
What's the best time and number to call you, if need be	
Number of DCs	
Number of Stores	
Number of cases	*Total, inclusive of tagged versions*

In the below grid please provide the targetted timelines in your company. Our intent is to get an orientation towards the timelines that your company has decided. For your reference, the vectors along which the questions are asked are shown below.



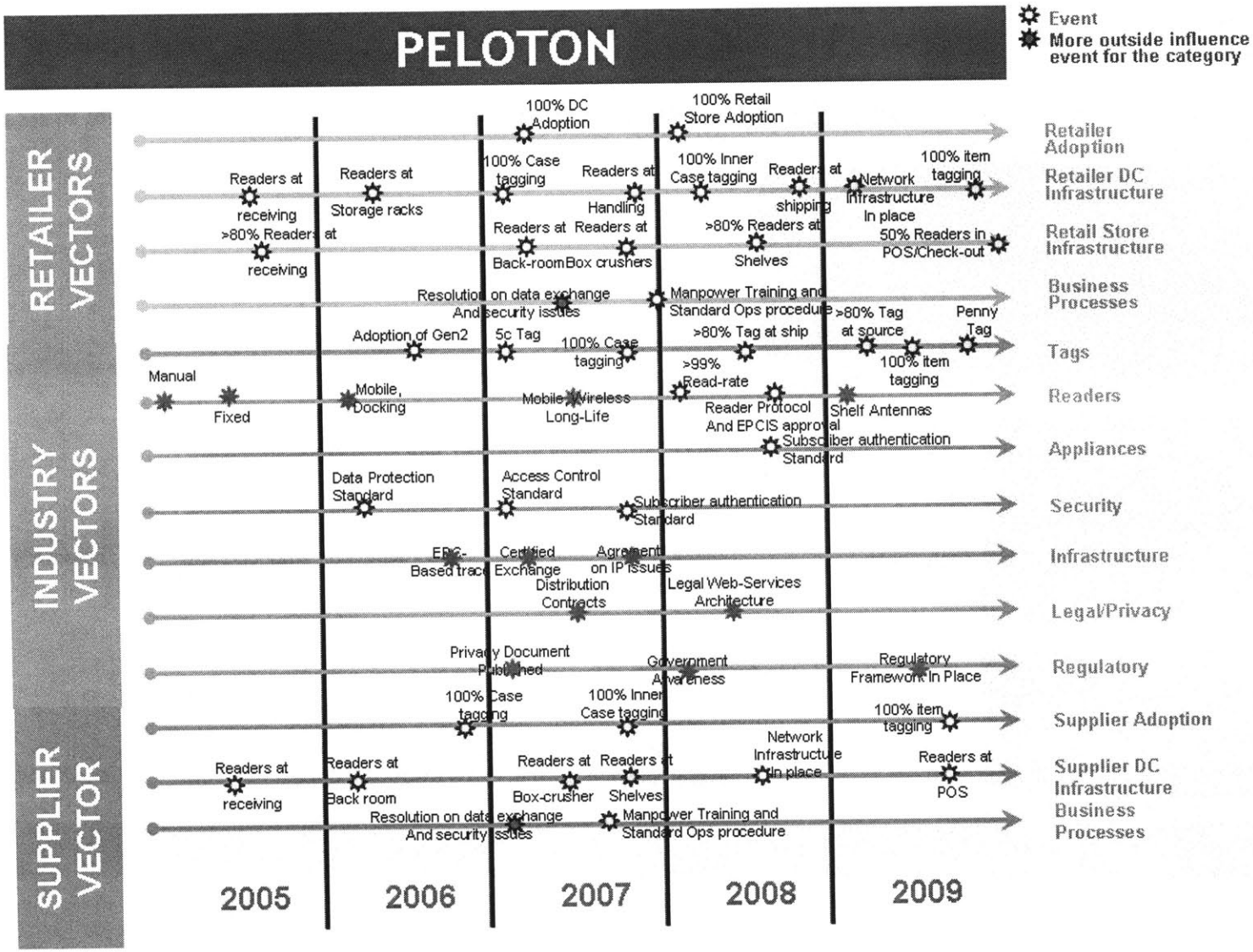
VECTOR	EVENT	LEVEL	QUARTER	YEAR	ADDITIONAL COMMENTS
Adoption	Pilot Testing of RFID Technology	5% or less cases			
		5% or less inners			
DC Adoption	Case tag expectations from supplier	less than 30%			
		50%			
		more than 80%			
	Inner tag expectation from supplier	less than 30%			
		50%			
		more than 80%			

VECTOR	EVENT	LEVEL	QUARTER	YEAR	ADDITIONAL COMMENTS
	Item tag expectation from supplier	less than 30%			
		50%			
		more than 80%			
	Number of DC's will be enabled *(Includes manpower training and laying down business processes)*	less than 30%			
		50%			
		more than 80%			
	Readers in Receiving Area*(Doors etc)*	less than 30%			
		50%			
		more than 80%			
	Readers on store racks	less than 30%			
		50%			
		more than 80%			
	Readers on handling *(conveyors, fork-trucks, hand-held devices, break-pack areas etc)*	less than 30%			
		50%			
		more than 80%			
	Readers on shipping *(Doors etc)*	less than 30%			
		50%			
		more than 80%			
	Other infrastructure at DC *(Eg. Network and software)*	less than 30%			
		50%			
		more than 80%			

VECTOR	EVENT	LEVEL	QUARTER	YEAR	ADDITIONAL COMMENTS
Store Adoption	Number of Stores Enabled *(Includes manpower training and laying down business processes)*	less than 30% 50% more than 80%			
	Readers in Back-room *(any area used to move products to the store floor; like tunnel, hallway etc)*	less than 30% 50% more than 80%			
	Readers on Box Crushers	less than 30% 50% more than 80%			
	Readers on Shelves *(Display shelves, store floor, PDQ, endcap area etc)*	less than 30% 50% more than 80%			
	Any plans for POS or customer Check-out areas?				
Category	What is your priority for categories to enable first? *(Eg.Start with high value products, then small products etc)*		1 2 3		
Geography	Which are the top 4 areas you wish to cover (Eg.Texas and central states, East Coast etc)		1 2 3 4		

VECTOR	EVENT	LEVEL	QUARTER	YEAR	ADDITIONAL COMMENTS
Concerns	What are the top 5 concern areas in RFID implementation (Please give Quarter and Year for it to be resolved)		1 2 3 4 5		
Concerns	Any concerns you have along: *(Please give Quarter and Year for it to be resolved)*	Public Policy Security Exchange of data with supplier	*(Eg.Standard)*		
Any other aspects of the RFID implementation strategy you wish to share with us?					

Please answer the four questions that follow the Peloton in the next page:


PELOTON
Event
More outside influence event for the category
RETAILER VECTORS
INDUSTRY VECTORS
SUPPLIER VECTOR
Retailer Adoption
Retailer DC Infrastructure
Retail Store Infrastructure
Business Processes
Tags
Readers
Appliances
Security
Infrastructure
Legal/Privacy
Regulatory
Supplier Adoption
Supplier DC Infrastructure
Business Processes
100% DC Adoption
100% Retail Store Adoption
Readers at receiving
Readers at Storage racks
100% Case tagging
Readers at Handling
100% Inner Case tagging
Readers at shipping
Network Infrastructure In place
100% item tagging
>80% Readers at receiving
Readers at Back-room
Readers at Box crushers
>80% Readers at Shelves
50% Readers in POS/Check-out
Resolution on data exchange And security issues
Manpower Training and Standard Ops procedure
Adoption of Gen2
5c Tag
100% Case tagging
>80% Tag at ship
>80% Tag at source
Penny Tag
100% item tagging
Manual
Fixed
Mobile, Docking
Mobile, Wireless Long-Life
>99% Read-rate
Reader Protocol And EPCIS approval
Shelf Antennas
Subscriber authentication Standard
Data Protection Standard
Access Control Standard
Subscriber authentication Standard
EPC-Based trac
Certified Exchange
Agreement on IP issues
Distribution Contracts
Legal Web-Services Architecture
Privacy Document Published
Government Awareness
Regulatory Framework In Place
100% Case tagging
100% Inner Case tagging
100% item tagging
Readers at receiving
Readers at Back room
Readers at Box-crusher
Readers at Shelves
Network Infrastructure in place
Readers at POS
Resolution on data exchange And security issues
Manpower Training and Standard Ops procedure
2005
2006
2007
2008
2009

1. Any event you think is not included in the Peloton in the RETAIL VECTORS	
2. Would you change any of the time lines?	
3. Any input you wish to provide on the Industry Vectors?	
4. Any input you wish to provide on the Supplier Vectors?	

1.3 Questionnaire: Supplier Version

PELOTON QUESTIONNAIRE - SUPPLIER VERSION

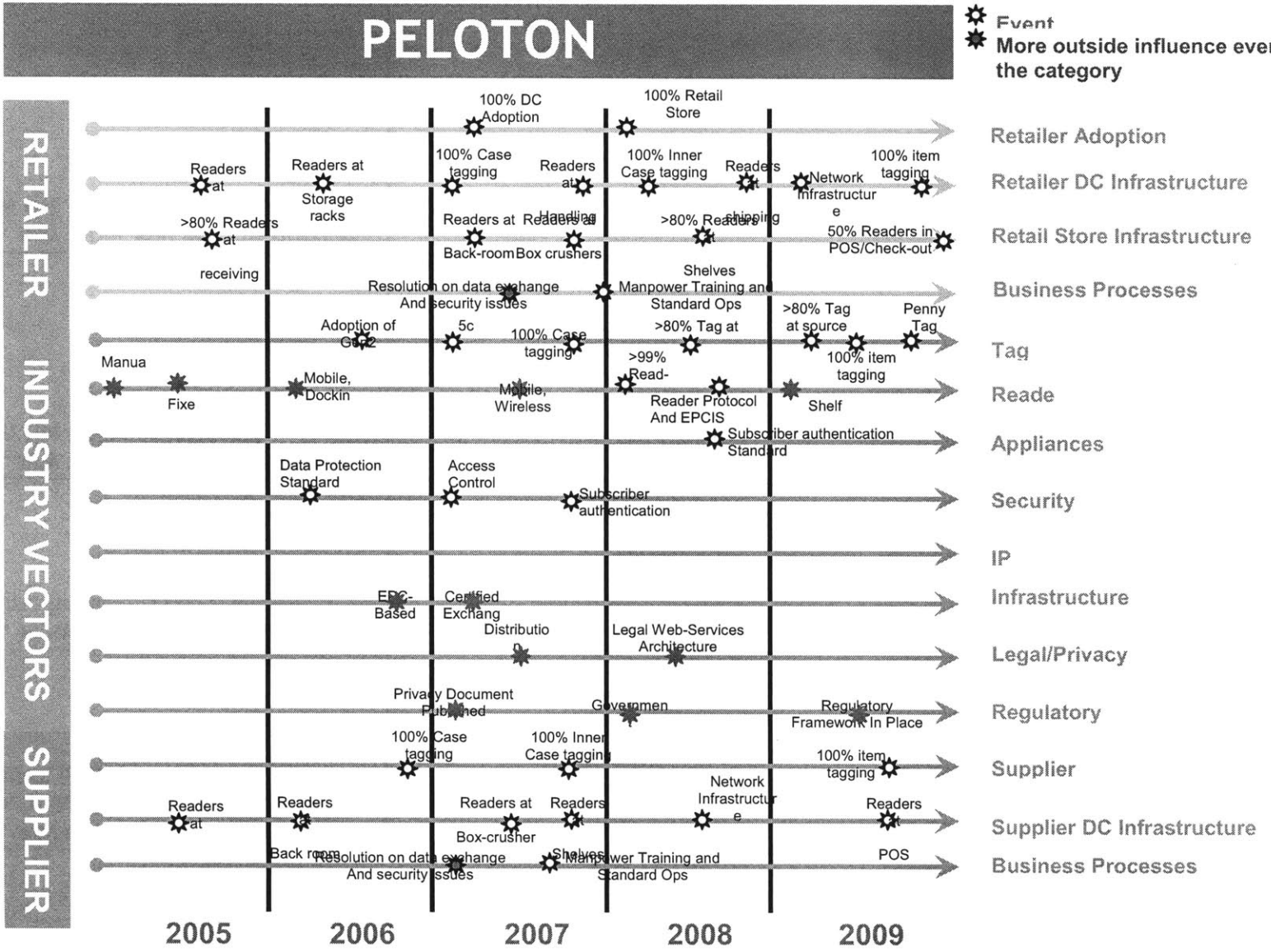
Thank you in advance for your time and support on the Peloton development and planning process. We request that you complete the questionnaire below in as much detail as possible, **by Wednesday, June 14, 2005**. You may also want to refer to the attached document (Summary of Peloton) for additional context. NOTE: This is a very preliminary document, on which we hope to expand upon using your responses to this questionnaire. Please direct any questions to Vineet Thuvara at MIT (vineet.thuvara@sloan.mit.edu or call 617-577-5634).

NOTE: IF THERE IS ANY CONFIDENTIAL INFORMATION YOU ARE PROVIDING, PLEASE LET US KNOW.

PLEASE BEGIN ANSWERING THE QUESTIONNAIRE BY PROVIDING YOUR CONTACT DETAILS .

Contact Name	
Title	
Company	
Phone	
email ID	
Location	
What's the best time and number to call you, if need be	

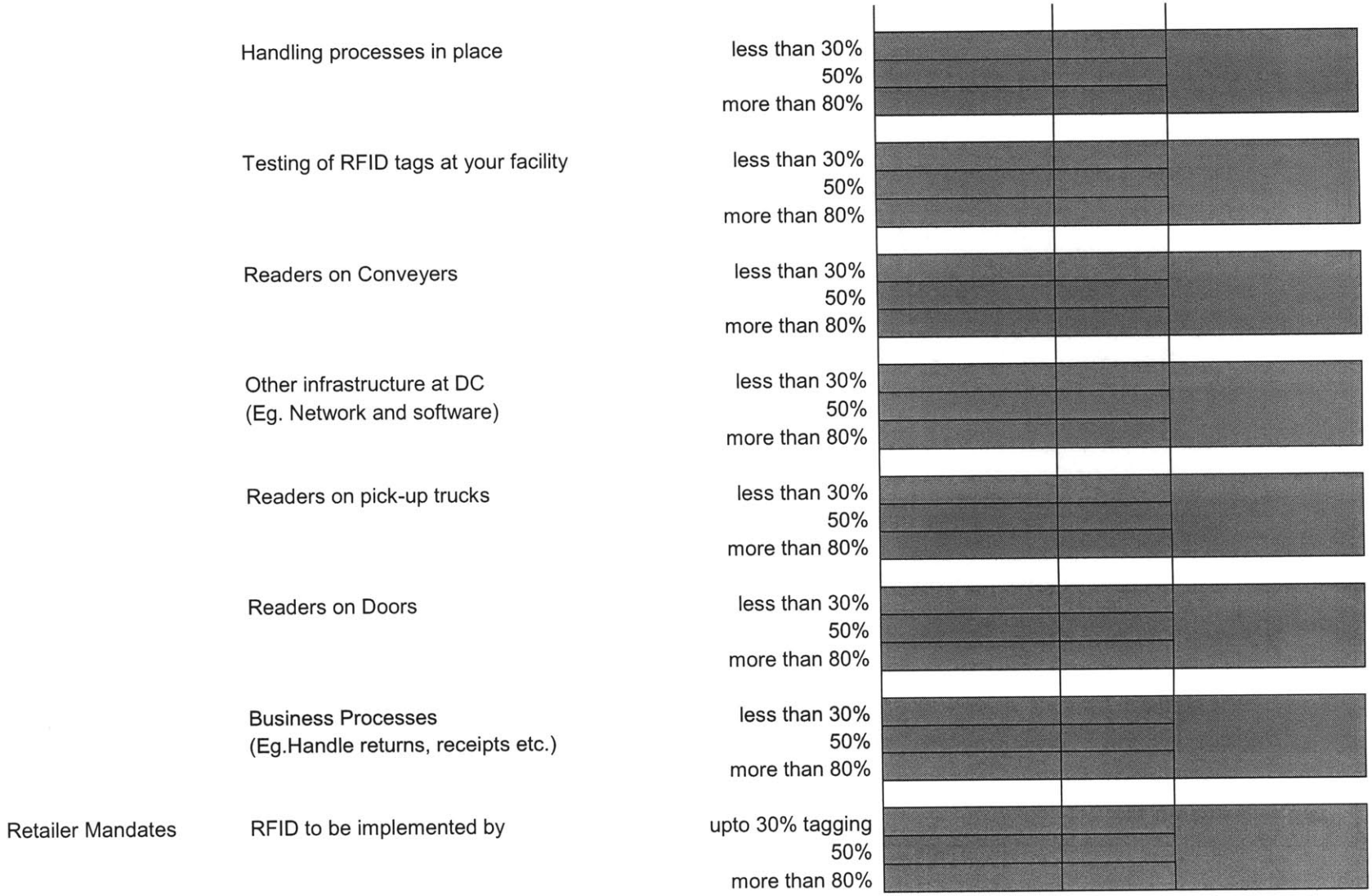
Please answer the two questions that follow the below Peloton:


PELOTON
RETAILER
INDUSTRY VECTORS
SUPPLIER
Event
More outside influence event for the category
Retailer Adoption
Retailer DC Infrastructure
Retail Store Infrastructure
Business Processes
Tag
Reade
Appliances
Security
IP
Infrastructure
Legal/Privacy
Regulatory
Supplier
Supplier DC Infrastructure
Business Processes
100% DC Adoption
100% Retail Store
Readers at
Storage racks
100% Case tagging
Readers at
100% Inner Case tagging
Readers at
Network Infrastructure
100% item tagging
>80% Readers at receiving
Readers at
Back-room
Handling
Box crushers
>80% Readers at
shipping
50% Readers in POS/Check-out
Resolution on data exchange And security issues
Shelves
Manpower Training and Standard Ops
Adoption of Gen2
5c
100% Case tagging
>80% Tag at
>80% Tag at spurce
Penny Tag
Manua
Fixe
Mobile, Docking
Mobile, Wireless
>99% Read-
Reader Protocol And EPCIS
100% item tagging
Shelf
Subscriber authentication Standard
Data Protection Standard
Access Control
Subscriber authentication
EPC-Based
Certified Exchang
Distributio n
Legal Web-Services Architecture
Privacy Document Published
Governmen t
Regulatory Framework In Place
100% Case tagging
100% Inner Case tagging
100% item tagging
Readers at
Readers
Readers at
Box-crusher
Readers
Network Infrastructure
Readers
Back rooms
Resolution on data exchange And security issues
Shelves
Manpower Training and Standard Ops
POS
2005
2006
2007
2008
2009

1. Any event you think is not included in the Peloton in the SUPPLIER VECTORS?	
2. Would you change any of the time lines?	
3. Any input you wish to provide on the Retailer Vectors?	
4. Any input you wish to provide on the Industry Vectors?	

In the below grid please provide the targetted timelines in your company. Our intent is to get an orientation towards the timelines that your company has decided

VECTOR	EVENT	LEVEL	QUARTER	YEAR	ADDITIONAL COMMENTS
Adoption	Pilot Testing of RFID Technology	5% or less cases			
		5% or less inners			
	Tag at Ship	less than 30%			
		50%			
		more than 80%			
	Tag at source	less than 30%			
		50%			
		more than 80%			
	Case tagged	less than 30%			
		50%			
		more than 80%			
	Inner tagged	less than 30%			
		50%			
		more than 80%			
	Item tagged	less than 30%			
		50%			
		more than 80%			
	Infrastructure planning at finished goods	less than 30%			
		50%			
		more than 80%			


Handling processes in place
less than 30%
50%
more than 80%
Testing of RFID tags at your facility
less than 30%
50%
more than 80%
Readers on Conveyers
less than 30%
50%
more than 80%
Other infrastructure at DC
(Eg. Network and software)
less than 30%
50%
more than 80%
Readers on pick-up trucks
less than 30%
50%
more than 80%
Readers on Doors
less than 30%
50%
more than 80%
Business Processes
(Eg.Handle returns, receipts etc.)
less than 30%
50%
more than 80%
Retailer Mandates
RFID to be implemented by
upto 30% tagging
50%
more than 80%

Geography	Which are the top 4 areas you wish to cover (Eg.Texas and central states, East Coast etc)	1 2 3 4
Concerns	What are the top 5 concern areas in RFID implementation *(Please give Quarter and Year for it to be resolved)*	1 2 3 4 5
What is the level of top management commitment on the RFID strategy	(Use 1-for High, 2-for Medium and 3-for Low)	
Any other aspect of the RFID implementation strategy you wish to share with us?		

2. Analysis of Responses

2.1 Industry Response Analysis

PELOTON

RESPONSE REPORT - INDUSTRY VERSION

NOTE: The consolidated responses are provided in the green section below the Quarter and Year headers. The timeline provided as "concentrated around" / "Conc" refers to a timeline when over 80% respondents would achieve that milestone.

Please direct any questions to Vineet Thuvara at MIT (Vineet.thuvara@sloan.mit.edu).

General Information on Responses

Number of supplier responses : 11

Companies are: High Tech Aid, UPS, Wells Dairy, Ingram Micro, MIC Business Solutions, Rush Tracking, Pacific Cycle, Lockheed Martin, Alien Tech Corp, Russell Corporation and Avicon.

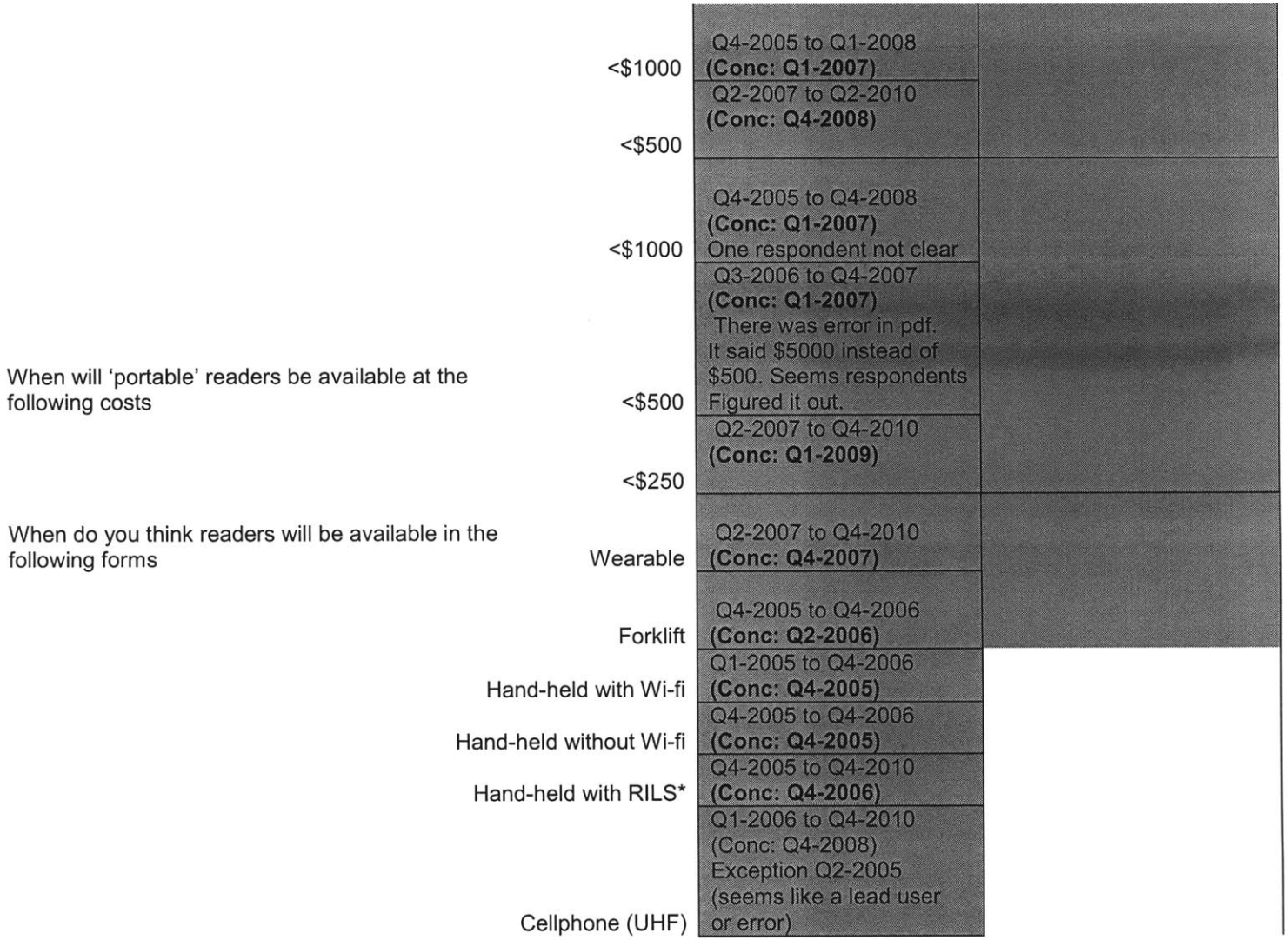
TAGS VECTOR

VECTOR	EVENT	LEVEL	QUARTER	YEAR	ADDITIONAL COMMENTS
Tags	To enable widespread adoption when do you think the cost of tags will be	15 cents	Q3-2005 to Q4-2007 **(Conc: Q3-2006)** Exception Q1-2010		
		10 cents	Q3-2006 to Q4-2008 **(Conc: Q1-2008)** 2 Exceptions 2010		
		5 cents	Q4-2007 to Q1-2012 **(Conc: Q1-2009)**		
		3 cents	Q3-2008 to Q1-2015 **(Conc: Q4-2010)**		
	To enable widespread adoption when do you think the cost of labels will be	20 cents	Q4-2005 to Q1-2008 **(Conc: Q4-2007)**		
		10 cents	Q1-2007 to Q1-2010 **(Conc: Q4-2008)**		
		5 cents	Q4-2008 to Q1-2015 **(Conc: Q1-2010)**		
	When do you think item level tagging will be adopted widely		Q1-2007 to Q1-2010 **(Conc: Q1-2010)**		

VECTOR	EVENT	LEVEL	QUARTER	YEAR	ADDITIONAL COMMENTS
	What technology do you anticipate being used in the item level tags? Select one (2D barcode, UHF, HF)		**UHF: 63% 2D Barcode: 27% HF: 9%** (Skew up)		
	When do you think Gen 2 tags will be available	In samples (10K)	Q3-2005 to Q1-2007 **(Conc: Q1-2006)**		
		In production quantity (1 million)	Q2-2006 to Q1-2009 **(Conc: Q1-2007)**		
	When do you think there will be need for tags with the following functionalities:	Temperature Sensor	Q1-2005 to Q4-2010 **(Conc: Q1-2006)**		One said there is need right now for all!
		Pressure Sensor	Q1-2005 to Q4-2010 **(Conc: Q1-2008)**		
		Humidity sensor	Q1-2005 to Q4-2010 **(Conc: Q1-2007)**		
		User memory	Q1-2005 to Q1-2008 **(Conc: Q1-2007)**		
		Anti-counterfeit	Q1-2005 to Q4-2010 **(Conc: Q4-2006)**		
		Any other_____	**No Specific Response**		
			Quarter	**Year**	**Addl. Comments**
	When do you think there will be need for tags which are:	Semi-Passive	Q1-2005 to Q4-2010 **(Conc: Q3-2006)**		One says we need them now! Different from above.
		Active	Q1-2005 to Q4-2010 **(Conc: Q1-2007)**		

READERS VECTOR

VECTOR	EVENT	LEVEL	QUARTER	YEAR	ADDITIONAL COMMENTS
Readers	What conveyor read rates are necessary to derive business benefits in your enterprise and when do you see them achieved? (singulated cases)	>90%	Q4-2005 to Q1-2006 **(Conc: Q4-2005)**		
		>95%	Q4-2005 to Q4-2006 **(Conc: Q2-2006)**		
		100%	Q4-2005 to Q4-2007 **(Conc: Q1-2007)**		
	When do you think the read rates on pallets (on pallet frames with heterogeneous or homogenous cases) In simple flow will be	>80%	Q2-2005 to Q2-2006 **(Conc: Q4-2005)**		
		>90%	Q4-2005 to Q2-2006 **(Conc: Q1-2006)**		
		95%	Q4-2005 to Q2-2007 **(Conc: Q4-2006)**		
	Does your business use multi-layered (sandwich) pallets with separately tagged layers?", and "		**No: 82% Yes: 18%**		
	If yes, What read rates for layer tags are acceptable for your business?		**For 'yes' above, Q4-2005**		
	When do you expect these read rates will be reached		**Q4-2005**		
	When will 'fixed/stationary' readers be available at the following costs	<$2000	Q4-2005 to Q4-2006 **(Conc: Q2-2006)**		



* RILS (Real Time Location System)

APPLIANCES VECTOR: Defined as an integrated solution/tool/machine with all physical components "hardware", potentially mechanical components, and 'middleware' integrated to be services and supported by one vendor.

VECTOR	EVENT	LEVEL	QUARTER	YEAR	ADDITIONAL COMMENTS
Appliances	When do you see the need for the following Appliances to derive business benefit:	Tag@Ship Appliance	Q2-2005 to Q4-2005 **(Conc: Q4-2005)**		**NOTE: Most people have found this section difficult to answer. Several respondents have preferred to chose N/A. Some expect too long for these and some see the need right now. The concentrations on the left column are based on three-four key responses. One exception to all answers was a time line of Q4-2010**
		Tag@Source Machine	Q2-2005 to Q1-2007 **(Conc: Q1-2007)**		
		Tag@Pick Appliance	Q2-2005 to Q4-2007 **(Conc: Q2-2006)**		
		Conveyor Appliance	Q2-2005 to Q4-2007 **(Conc: Q1-2006)**		
		Large-load pickup & put-away fork/clamp truck appliance	Q4-2005 to Q4-2007 **(Conc: Q4-2006)**		
		case picking fork truck appliance	Q4-2005 to Q4-2006 **(Conc: Q1-2006)**		
		Portable/Handheld Appliance	Q2-2005 to Q4-2005 **(Conc: Q4-2005)**		
		Wearable Appliance	**Q4-2006 to Q4-2007** (Only 3 clear responses)		
		What other Appliances are needed?			
	When will we have on-line/in-line tag applicators (read, write, apply, verify) ?	At 30 tags/min	Q4-2005 to Q4-2006 **(Conc: Q1-2006)** Only Four clear answers		
		At 100 tags/min	Q2-2006 to Q4-2007 **(Conc: Q4-2006)** Exception Q4-2010		
		At 300 tags/min	Q4-2006 to Q4-2010 **(Conc: Q4-2008)**		

SECURITY VECTOR

RESPONSE RELATED NOTE: The responses to the timelines on the security vector is very low. So time lines may not be statistically significant.
Only three respondents have mentioned anything on timelines. Some have, however given subjective information.

VECTOR	EVENT	ADDITIONAL COMMENTS	
Security	What level of data protection security does your company require and by when?	Low to Medium Access Control through Encryption, IS Access. Q4-2005 (Conc.)-2007	
	What are your requirements to authenticate trading partners or facilitate information sharing?	IP Address, AS2/Digital Certificate, Public Key, ID/Password Q4-2005 (Conc.)-2007	
	What are your requirements to access control for trading partners or facilitate information sharing?	From low importance to most important range. As2/Digital Certificate, IP Address.	
	Based on your plans to share EPC information do you feel that digital certificates are sufficient for exchanging information or should something more stringent be in place?	For both the above questions, Responded as access control and security sufficient at this point of time. Most people are undecided	
	What are your company's plans for the deployment of a federated security model (Liberty Alliance, WS)? Do you have a preference?		
	What components of the EPCglobal network do you feel needs an industry wide security strategy? What are your priorities?	One respondent says EPCIS and One says Discovery. Others undecided/no response.	

INFRASTRUCTURE/ NETWORK STANDARDS VECTOR

VECTOR	EVENT	RESPONSES	
Infrastructure/ Network Standards	Do you expect tier 1 retailers/manufacturers to adopt Gen 2 standard	**100% Yes**	Q1-2006 to Q2-2008 **(Conc: Q2-2007)**
	Do you anticipate the need for the updated Tag Data Standard to be approved and ratified?	**100% Yes**	Q3-2005 to Q4-2007 **(Conc: Q4-2005)**
	Do you anticipate the need for the Reader protocol Standard to be approved and ratified?	**91% Yes** **9% No**	Q4-2005 to Q4-2007 **(Conc: Q4-2006)**
	When do you anticipate the need for the Reader Management Standard to be approved and ratified?	**91% Yes** **1 No answer**	**(Conc: Q4-2006)** Many non-responses
	When do you anticipate the need for the EPCIS Standard to be approved and ratified?	**82% Yes** **18% No**	Q2-2006 to Q4-2010 **(Conc: Q4-2006)**
	Do you anticipate a need for Discovery Services and when would a standard be required?	**64% Yes** **27% No, 1 No Answer**	Q3-2006 to Q4-2010 **(Conc: Q4-2006)**
	Do you anticipate a need for Subscriber Authentication and when would a standard be required?	**91% Yes** **9% No**	Q4-2006 to Q4-2008 **(Conc: Q3-2007)**

LEGAL/PRIVACY/PUBLIC POLICY/REGULATORY VECTOR

RESPONSE RELATED NOTE: ONLY 2 ATTEMPTED ALL QUESTIONS AND 4 OTHERS SPARINGLY ADDERESSED SOME.

VECTOR	EVENT	RESPONSES
LEGAL/PRIVACY/PUBLIC POLICY/REGULATORY VECTOR	List any legal/privacy issues you anticipate as roadblocks and when they need to be Resolved	**Industry Policy, IP Issues, Public Education of passive tags, item level tagging and legal framework**
	List any IP issues you anticipate as roadblocks and when they need to be resolved	**Resolve Symbol/Intermec issues ASAP. Two say IP not an issue.**
	List any Consumer and Employee protection issues you anticipate as roadblocks and when they need to be resolved	**Radiating devices can create public issues.**
	List any Consumer and Employee health & safety protection issues, due to electromagnetic radio frequency exposure, you anticipate as roadblocks and when they need to be resolved	**Education**
	List any Consumer confidence and trust perception issues and when they need to be resolved	**When item level tagging occurs**
	List any contracting, or international commerce issues you anticipate as roadblocks and when they need to be resolved	**Read accuracy, Standards, General availability of frequency**
	List any international antitrust/competition issues you anticipate and when they need to be resolved	**IP issues??**
	List any data protection, integrity, quality, control, security and cross-border data transfer issues you anticipate and when they need to be resolved	**None**
	List any environmental issues you anticipate as roadblocks and when they need to be resolved	**Recycling Tags and Tag disposal issues could be.**
	List any security issues (security in the sense of the illicit use of the EPCglobal Network) as roadblocks and when they need to be resolved	**None.**
	List any labour relation issues as roadblocks and when they need to be resolved	**None. One says reviewing**
	List any other issues you anticipate	**None**

SERVICE PROVIDERS VECTOR

VECTOR	EVENT	COMMENTS
Service Providers	What issues are important from the viewpoint of enabling third party logistic (3PLs) and other providers?	**Data Exchange, Standard Technology, Protocols, Handling SGTIN, Contract requirements** Q2-2006 to Q4-2010 **(Conc: Q2-2007)**
	What are the data sharing issues that you foresee with regards to 3PLs?	Ownership of Supply chain, Manager number assignment by 3PL, Security and standard protocol and consistent data standards. Q4-2006 to Q2-2007 (only three responses)

GENERAL QUESTIONS:

In addition to the Vector related events, we would like to provide us some additional feedback to get a complete and subjective picture of the issues involved

OTHER	EVENT	LEVEL	RESPONSES		
General Pricing	What pricing do you think will support	a. Case tagging	1 to 30 cents (Conc: 20 cents)		
		b. inner tgging	1 -5 Cents		
		c. unit tagging	1-15 Cents (Conc: 5 cents)		
Geography	Which are the top 4 geographical areas you wish to cover		US, Europe, Asia (mainly China & Japan) In US generally all over.		
Concerns	What are the top 5 concern areas in RFID implementation *(Please provide a quarter and year for these to be resolved)*	1. Tag Costs	Q1	2007	Aerospace is moving in its own direction. Asia is not committed right now. Conflict over UHF/HF.
		2. Read Rate	Q3	2006	
		3. Security/Privacy issues	Q4	2007	
		4. ROI Examples			
		5. Industry Readiness & Regulation	Q4	2007	
		6. Additional data handling challenges	Q4	2007	

1. Any event you think is not included in the Peloton in the INDUSTRY VECTORS?	This is the most complex hard to understand survey I have been asked to participate in. Surveys should be simple. I got frustrated. Worldwide availability of compatible frequencies and protocols.
2. Any input you wish to provide on the Retailer Vectors?	Readable 6 sigma read rates to be achieved at carton level. Industry as a whole should allow for a maturing technology without charge-backs.
3. Any input you wish to provide on the Supplier Vectors?	None

If need be will you be willing to speak to us, if we have any clarification? Yes/No

If yes, what is the best telephone number and time to call you up? 5 respondents provided numbers to call

2.2 Retailer Response Analysis

PELOTON

RESPONSE REPORT - RETAILER VERSION

HOW TO LOOK AT THE RESPONSE ANALYSIS

The consolidated responses are provided in the green section below the Quarter and Year headers.
There are three elements of each analysis:

1. Range of timelines
2. CONC Timeline - The timeline provided as "CONC" refers to "concentrated around" a timeline when over 80% respondents would achieve that milestone (Vineet's estimate)
3. MED Timeline - The timeline provided as "MED" refers to the statistical median timeline.

NOTE: Wherever only "CONC" appears, the "MED" and "CONC" more or less coincide. Additionally in case of the Retail responses, since there are only 4 respondents, MEDIAN is hard to find in most cases. I have used my best guess of Median here.

Please direct any questions to Vineet Thuvara at MIT (Vineet.thuvara@sloan.mit.edu).

General Information on Responses

Number of Retailer responses : 4

Companies Wal-Mart, Albertsons, Target, CVS Pharmacy

GENERAL INFORMATION

Number of DCs : 3-100+
Number of Stores : 1 Store to 5400 stores
Number of cases : 1 billion to 3.5 billion

RETAILER ADOPTION VECTOR: Primarily dealing with your initial adoption

EVENT	LEVEL	TIMELINE	ADDITIONAL COMMENTS
1. When will you Pilot RFID Technology?	5% or less cases	Q1-2005 to Q3-2007 **(CONC: Q2-2005)**	
	5% or less inners	Q1-2005 to Q1-2006 **(CONC: Q2-2005)**	
2. Do you anticipate piloting retail unit tagging?	Yes/No	All Yes	
	If yes, when	Q1-2005 to Q3-2007 **(CONC: Q3-2006)** **(MED: Q3-2005)**	
3. At what level and when do you expect 'Case Tagging' by your suppliers to happen	less than 30%	Q1-2005 to Q3-2006 **(CONC: Q3-2006)** **(MED: Q2-2005)**	
	less than 50%	Q1-2006 to Q4-2006 **(CONC: Q4-2006)** **(MED: Q2-2005)**	
	more than 80%	Q4-2006 to Q4-2007 **(CONC: Q4-2007)** **(MED: Q1-2007)**	
4. At what level and when do you expect 'Inner Tagging' by your suppliers to happen	less than 30%	Q1-2005 to Q3-2005 **(CONC: Q3-2005)** **(MED: Q1-2005)**	
	less than 50%	Q3-2006 to Q1-2008 **(CONC: Q1-2008)** **(MED: Q4-2007)**	
	more than 80%	Q3-2007 to Q1-2009 **(CONC: Q1-2009)** **(MED: Q4-2008)**	
5. Which technology (2D Barcode, UHF or HF) best suits your need for item level tagging? (select one from the three)		**3 UHF, 1 HF**	

DC INFRASTRUCTURE VECTOR: Dealing with your DC readiness in terms of reader and other tagging infrastructure in place.

EVENT	LEVEL	TIMELINE	ADDITIONAL COMMENTS
6. What percentage of products flowing through your DCs will be EPC enabled? (Includes manpower training and laying down business processes, network and IP infrastructure to enable EPC)	less than 30% less than 50% more than 80%	Q1-2005-Q3-2007 **CONC: Q3-2007** **MED:Q2-2005** Q4-2006-Q4-2008 **CONC: Q4-2008** **MED:Q3-2007** Q4-2007-Q4-2009 **CONC: Q4-2009** **MED:---**	

Based on the above timeframe for enabling DCs, Do you anticipate the following locations to be enabled with readers?

7. Lorry/Truck (Receiving)	Initial Implementation *Final Implementation*	**Q3-2005** **Q1-Q4-2008**	
		Q2-2005-Q2-2006 **CONC: Q2-2006**	
8. DC in (Receiving)	Initial Implementation *Final Implementation*	Q3-2008-Q42010 **MED: Q4-2008**	
9. Conveyor	Initial Implementation	Q3-2005-Q3-2007 **MED: Q3-2007**	
	Final Implementation Initial Implementation	Q4-2008 to 2010 **MED: 2008**	
10. Break Pack area	*Final Implementation*	Q3-2005-Q3-2007 **MED: Q3-2006**	

			Q4-2008-2010 **MED: Q4-2008**
		Initial Implementation	Q2-2005-Q3-2006 **MED: Q3-2005**
11.	DC out (Shipping)		
		Final Implementation	Q3-2008-Q4-2010 **MED: Q3-2008**

Note: * *Final implementation is referred to as a subsequent expansion of the reader network to all/most locations*
Initial Implementation refers to first trials and the initial phase.

STORE INFRASTRUCTURE VECTOR: Deals with kind of products you intend to tag, the geographical reach and infrastructure at shipment.

EVENT	LEVEL	TIMELINE	ADDITIONAL COMMENTS
12. What is your plan on your Stores to be enabled? *(Includes manpower training and implementing business processes, network and IP infrastructure to enable EPC)*	less than 30% less than 50% more than 80%	2005 2005 - Q3-2008 **CONC: Q3-2008** Q2-2008- Q3-2010 **MED: Q2-2008**	

Based on the above timeframe for enabling stores, do you anticipate the below locations to be enabled with readers?

		Initial Implementation	Q1-2005 t0 Q2-2007 **CONC: Q2-2007** **MED: Q2-2005**
13.	Doors (Receiving)		
		Final Implementation	Q2-2008 t0 Q3-2010 **CONC: Q2-2010**
		Initial Implementation	**CONC: Q2-2005**
14.	Back Room Doors		

	Final Implementation	Q2-2008 t0 Q3-2010 **CONC: Q3-2010**
	Initial Implementation	**MED: Q2-2005**
15. Box-Crushers	*Final Implementation*	Q2-2008 t0 Q3-2010 **CONC: Q2-2010**
	Initial Implementation	Q1-2005 t0 Q2-2007 **CONC: Q2-2007** **MED: Q2-2005**
16. Retail Shelves	*Final Implementation*	Q2-2005 t0 Q3-2007 **CONC: Q3-2007**
	Initial Implementation	Q2-2006 t0 Q2-2009 **CONC: Q2-2009**
17. POS Check-out	*Final Implementation*	Q2-2009 t0 Q3-2010 **CONC: Q3-2010**
	Initial Implementation	**CONC: Q2-2009** **Only One response**
18. Loss Prevention system integration	*Final Implementation*	Q1-2008 t0 Q2-2010 **CONC: Q2-2010** **(2 Responses** **Q2-Q3-2007**
19. Returns and Exchange/ customer service counters	Initial Implementation *Final Implementation*	

EVENT	LEVEL	TIMELINE	ADDITIONAL COMMENTS
20. POS Check-out	Initial Implementation *Final Implementation*	**REPEATED QUESTION**	
21. What is your priority for product categories or departments to be enabled first? *(E.g. Start with high value products, then small products Health and Cosmetics, etc)*		**1 to all categories. I pharma**	
22. Which are the top 4 areas you wish to cover in terms of Geography?		**One pilot in Dallas. Rest all spread all over US.**	

BUSINESS PROCESSES VECTOR: Related to data exchange formats, security, manpower training and operational issues.

EVENT	LEVEL	TIMELINES	ADDITIONAL COMMENTS
23. Do you intend to share your EPC data with your suppliers? *If yes, please specify timeline for batch and/or Real time*	Yes/No In Batch In real-time	**3 Yes and 1 No** No clear timeline expressed	
24. *If yes do you intend to charge your partners/3PL*	Yes /No	**3 YES and 1 NO**	

When do you anticipate standardizing EPC enabled Business processes for the following?

25.	*ePOD (Electronic Proof of Delivery)*	**2007-2010**
26.	*Out of stock (OOS) reduction*	**Q1-2007 to Q1-2008** Q2-2006 to Q2-2009
27.	*Promotional execution*	**MED: Q3-2006**
28.	*Returns*	**Q3-2010 (one response)**
29.	*Plan-a-gram & space management performance*	**Q2-2007 to Q3-2010**
30.	Product locator	**Unclear**
31.	What other areas are you looking at using EPC track and trace data?	**Softlines hanging, pharmacy, Cold Chain, DSD, Authentication, Customer service, Bakery supplies, bag and tray products**
32.	*Any others*	**None**

GENERAL QUESTIONS OUTSIDE THE VECTORS

In addition to the Vector related events, we would like you to provide us with some additional feedback to get a complete and subjective picture of the issues involved

EVENT			QUARTER 1 2 3 4	YEAR	ADDITIONAL COMMENTS
33. What are the top 5 concern areas in RFID implementation (Please give Quarter and Year for it to be resolved) Concern 1	**1**	Read Rate	Q2-2006		
	2	Reliability	Q3-2006 to Q2-2007		
	3	Privacy	Q1-2006 to Q2-2008		
	4	Cost	**Q3-2006** to Q2-2009		**Bold timelines indicate general skewness towards that timeline**
	5	Expertise	Q3-2006		
	6	Standards	Q2-2007		
	7	Data exchange issues	Q2-2006		
	8	EPCIS, EPC membership	2006		**Suppliers looking for reduced initial costs. Scale up should be done after they attain optimal item tagging.**
	9	Sensor Tags			

Please answer the questions that follow the Peloton:

34. Any event you think is not included in the Peloton in the RETAIL VECTORS	Privacy Issues and concerns with consumers
35. Any input you wish to provide on the Industry Vectors?	None
36. Any input you wish to provide on the Supplier Vectors?	None

THANK YOU

2.3 Supplier Response Analysis

PELOTON

RESPONSE REPORT – SUPPLIER VERSION

NOTE: The consolidated responses are provided in the green section below the Quarter and Year headers. The timeline provided as "concentrated around" / "Conc" refers to a timeline when over 80% respondents would achieve that milestone.

Please direct any questions to Vineet Thuvara at MIT (Vineet.thuvara@sloan.mit.edu).

General Information on Responses

Number of supplier responses : 12

Companies are: Levi's Strauss, Michelina, CH Robinson, Tyson Foods, The Gillette Company, Solo-Cup, Thomasville, Kimberley-Clark, Black&Decker, Scotts, Bell Sports and H&R Block.

VECTOR	EVENT	LEVEL	QUARTER	YEAR	ADDITIONAL COMMENTS
Supplier Sources	At what point do you expect to see 'case tagged' at the source level?	less than 30% of SKUs	Q4- 2005 to Q1-2007 **(Concentration around Q4 2006)** One company implemented in early 2005 (need to call them)		
		50% of SKUs	Q3-2006 to Q4-2010 **(Concentration Q1-2008)** One company in early 2005 (need to call them)		
		more than 80%	Q3-2006 to Q4-2010 **(Conc: Q1 2009)**		
	At what point do you expect to see 'inners tagged' at the source level?	less than 30% of SKUs	Q4-2007 to Q1-2010 **(Concentrated around Q1 2009)** [4 Companies implemented in early 2005]		

VECTOR	EVENT	LEVEL	QUARTER YEAR	ADDITIONAL COMMENTS
			Q2-2006 to Q2-2010 **(Conc: Q1-2009)** [4 Companies implemented in early 2005]	
		50%		
			Q2-2006 to Q1-2015 **(Conc: Q1-2010)** [3 Companies implemented in Q1-2005]	
		more than 80%		
	At what point do you expect to see 'items tagged' at the source level?	less than 30% of SKUs	Q1-2006 to Q2-2010 **(Conc: Q4-2006)**	
		50%	Q2-2006 to Q2-2010 **(Conc: Q4-2008)**	
		more than 80%	**Max: Q4-2010** (One Company says 2005. Need to call)	
	At what point do you expect to tag at source?	Beginning Date		
		Expected Completion date	Q1-2006 to Q1-2010 **(Conc: Q4-2006)** [2 say 2005]	
		# of locations (Please specify number of primary source locations in North America)	# from 1 to 300	
	What is your plan RFID implementation in terms of number of manufacturing lines (in North America)?		#	
		What percentage	**100% all**	
		Completion date	**Max: Q4-2008**	

SUPPLIER DC INFRASTRUCTURE VECTOR: Refers to your plan for readiness to implement RFID in your DCs.

VECTOR	EVENT	LEVEL	QUARTER	YEAR	ADDITIONAL COMMENTS
Supplier DC Infrastructure	When and what level you plan to Pilot RFID Technology?	5% or less cases	**Q4-2005**		
			Q1-2005 to Q4-2008 **(Con: Q1-2007)**		
		5% or less inners	Q1-2007 to Q4-2010 **(Conc: Q4-2008)**		
		5% or less units			
	When and at what level do you see Tag at Ship in your organization?	less than 30%	Q1-2005 to Q4-2007 **(Conc: Q4-2005)**		
		50%	Q1-2005 to Q4-2009 **(Conc: Q2-2008)**		
		more than 80%	Q1-2005 to Q4-2010 **(Conc: Q2-2008)**		

VECTOR	EVENT	LEVEL	QUARTER	YEAR	ADDITIONAL COMMENTS
	What is your status on tag@ship DC enablement?	Date of First DC enablement	All by (Q2) 2005		
		Final DC enablement	Max Q2-2006		
		Total number of DC's to enable in North America	# 1 to 18		
	Are you planning to verify 100% of your EPC data prior to shipping?	Yes/No	All YES		
	What is your plan for 'Roll Cage tagging'?	less than 30%	Mostly Unanswered		
		50%	Mostly Unanswered		
		more than 80%	Mostly Unanswered		
	What is your plan for 'tote tagging'?	less than 30%	Mostly Unanswered		
		50%	Mostly Unanswered		
		more than 80%	Mostly Unanswered		
	Which are the top 4 geographic areas you wish to cover		1 2 3 4		Mian are NE, S&MW, West Coast. Some mention Asia, Europe, Latin America etc.

BUSINESS PROCESS VECTOR: Refers to your plan for readiness to implement RFID with respect to people training, processes and use of EPC data.

VECTOR	EVENT	QUARTER	YEAR	ADDITIONAL COMMENTS
Business Processes	When do you anticipate implementation of standardized EPC enabled processes	Q2-2005 to Q3-2007 **(Conc: Q1-2007)**		
	Estimated timeline for using EPC data beyond supply chain operations (Eg. To achieve optimized production)	Q2-2007 to Q4-2010 **(Conc: Q4-2008)**		

GENERAL QUESTIONS

In addition to the Vector related events, we would like to provide us some additional feedback to get a complete and subjective picture of the issues involved

OTHER	EVENT	ADDITIONAL COMMENTS
Concerns	What are the top 5 concern areas in RFID implementation *(Please give Quarter and Year for it to be resolved)*	**1. Tag Cost / ROI** **2. Technology Reliability** **3. Data Integration** **4. Regulation** **5. Item Cataloging**

Please answer the four questions that follow the Peloton in the next page.

1. Any event you think is not included in the Peloton in the SUPPLIER VECTORS?	**None Filled this**
2. Any input you wish to provide on the Retailer Vectors?	**Item level Tag Standard for Apparel. Need aggressive batch data sharing timeline**
3. Any input you wish to provide on the Industry Vectors?	**RFID software related information** **Data Analysis software** **Mobile readers**

We wish to sincerely thank you for your valuable time and inputs.

If need be will you be willing to speak to us, if we have any clarification? Yes/No

If yes, what is the best telephone number and time to call you up? _Only three filled this section_____

THANK YOU

3. Respondent Information

PELOTON QUESTIONNAIRE ROUND II a and b RESPONSE TRACKING Early Fall 2005						
RESPONDENT NAME	SUPPLIER	RETAILER	INDUSTRY	RESPONSE/ CORRESP'CE RECD ON	COMMENTS	EMAIL ID
Ed Sofia	1			30-Jun-05		ed.sofia@bdk.com
Kuhnlein, Jeffery J	1			30-Jun-05		jkuhnlein@thomasville.com
O'Shea, Mike	1			30-Jun-05		mdoshea@kcc.com
Keigo, Ando			1	29-Jun-05		keigo.ando@mitshubishicorp.com
Schmidt, Andy	1			29-Jun		aschmidt@sunmaid.com
Jackson, Jerry				29-Jun	Not sure if he will respond	jerry.jackson@revlon.com
Matthews, Ed			1	29-Jun		ematthews@pacific-cycle.com
Fox, John	1					John.Fox@remington.com
Marc Linster			1	30-Jun-05		mlinster@avicon.com
Raymond				28-Jun-05	Gay to remind. Asks who's the beneficiary?	raymond@truedemandsoftware.com
Markwardt, Herbert	1			30-Jun-05		herbert.markwardt@tyson.com
Mattinson, John	1			30-Jun-05		John.Mattinson@Scotts.com
Alan Fang	1			1-Jul-05		afang@bellsports.com
Luis Dowling	1			1-Jul-05		Luis.Dowling@chrobinson.com
Michaelson, Dale	1			1-Jul-05		dmichaelson@michelinas.com
Steve Halliday			1	1-Jul-05		steve@hightechaid.com
Brown Russel			1	1-Jul-05		BrownRussell@russellcorp.com

Nonneman Bob			1	1-Jul-05		bnonneman@ups.com
Toby Rush			1	1-Jul-05		Toby.Rush@RushTrackingSystems.com
Tom Pounds			1	2-Jul-05		TPounds@AlienTechnology.com
Jonathan Starr	1			2-Jul-05		Jonathan.Starr@solocup.com
Smentek, Matt			1	2-Jul-05		matthew.smentek@IngramMicro.com
Horton, Todd	1			2-Jul-05		todd.horton@hrblock.com
Kaufman, Derek	1			2-Jul-05		DKaufman@levi.com
David Vaske			1	2-Jul-05		DIVaske@bluebunny.com
Clark, Denton			1			denton.clark@lmco.com
Sertl (Garrett), Elizabeth					Awaited. Send word version on July 20 as she could not handle pdf.	Elizabeth.Sertl@anheuser-busch.com
Rick.Schendel					Someone else from Target answered	Rick.Schendel@target.com
Ed Gill	1					ed.gill@jockey.com
Jeffery Jacobsen			1			jeff@awid.com
Vishal Vaid			1			vishal.vaid@bearingpoint.com
Jan-Willem Reynaerts					European Supplier. Will be evaluated with Europe group	Jan-Willem.Reynaerts@philips.com
Jack DeAlmo		1				jldealmo@cvs.com
Deepak Advani		1				deepak.advani@target.com
Kevin Brown	1					KBrown@daisybrand.com
Brian, James	1				Received Fax	Brian.James@hamiltonbeach.com
Lamagna, James			1			James.Lamagna@DELMONTE.com
Lamagna, James	1					James.Lamagna@DELMONTE.com
Simon Langford		1			Email from Ron Moser	simon.langford@wal-mart.com
Jay Fryman			1			jfryman@identitraktech.com

Gary Stegall					Got blank Q're. Reminded Jul 20. provided fax number too. Vineet to follow up	GaryStegall@kayser-roth.com
Total	**17**	**3**	**15**		**35**	
INCLUDED BELOW ARE VECTOR LEAD RESPONSES FROM THE EARLIER ROUND (DRAFT WORD QUEASTIONNAIRE)						
Steve Rehling	1				Responded. Need to map word version	Rehling.sf@pg.com
Bob Mytkowicz					Received word version. Gillette has responded. Will have Dirk for one-on-one	
Leo					Gillette has responded. Will have Dirk for one-on-one.	
Dirk Hyeman					Gillette has responded. Will have Dirk for one-on-one.	
Michelle (Albertsons)		1			Received pdf	michelle.borninkhof@albertsons.com
Nancy Tai/Francis Cioffi	1				Got word version. Compiled into first analysis. Need pdf if possible	fjcioffi@gapac.com
Richard Lee	1				Received pdf	

Robert Paul					received word version of responses	paul.roberts@uk.nestle.com
Sue Hutchinson			1		pdf received	shutchinson@apcglobalus.org
Dr. Gerd Wolfram (Metro),						
Ervin Veer (Ahold),						
Paul Freeman (Best Buy) (only gave some very general inputs in the questions being asked. No answers)						
Ian Robertson (HP),						
Sanjay Sarma (MIT), (Has provided detailed feedback on the questions)					Discussed	
Chris Diorio (Impinj),						
Ken Traub (Connecterra),						
Hap Peterson (Tyco),						
Lori Denham (Public Policy US),						
Antonia Voerst (Public Policy EU),						
Bernie Hogan (EPCglobal),						
Nicholas Fergusson						
	20	4	16		40	

4. Key Concerns around RFID

Concern (in decending order of # responses)	Tally of Responses	Timeline inputs (extracted 2 columns from The total sample)		Mean Timeline in Quarters from 2005
Tag cost/affordability	24	9	18	8.5
ROI	15	6	4	5.9
Read Rate	11	6	6	7.3
Reliability	10	7	4	4.2
Data X, Analysis, Sync, Intg	10	6	5	6.5
Standards	8	10	8	5.1
Gen 2 Avail	8	4	5	4.6
Technology Performance	7	6	12	5.9
Reader/Devise Cost	6	12	10	6.2
Retail Push	5	6	4	5.2
Privacy	4	14	5	12.0
Migration	4	8	5	4.5
Maturity	3	10	12	11.3
Security	3	8	12	14.3
Business Proceesses	3			0.0
Item level affordability	2	6	7	6.5
EPCIS	2			0.0
Lack of Quality Vendors	2	7	4	5.5
EPC Supplier fees	1			0.0
Reader form factor	1	6		6.0
Temperature sensitive tags	1			0.0
Industry Expertise	1	7		7.0

Tag at Source	1	16	16.0
Regulation	1	12	12.0
Success at Print	1	6	6.0
Needs of Apparel industry	1	7	7.0
High speed applicators	1	6	6.0
Asian Adoption	1	9	9.0
Wireless readers	1	10	10.0
RFID middleware	1	4	4.0
Enterprise Solution	1	4	4.0
Item Catalogue (GTINS)	1	4	4.0
Non-Metallic Tags	1	21	21.0
Forklift readers	1	6	6.0
Public Policy	1	11	11.0
Tech Obsolescence	1		0.0
Scalability	1	5	5.0
Legislation	1	5	5.0
Partner disclosure	1		0.0
Manpower training	1	5	5.0
Customer Adoption	1		0.0
Volume Tagging	1		0.0
Success Stories	1		0.0

Section 14

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