PLM – RFID Combined Solutions to Solve New Business Issues

Increasing awareness on customer safety and environment awareness has influenced governments to create new legislations like TREAD act, EU food safety legislation, and End of Life Vehicle legislation. These legislations ask the companies to track its products from inception till its retirement. These regulations, along with existing product lifecycle issues, are divided into five critical issue categories like product recall, getting the right part at right place at right time, Service and maintenance, End of life vehicle issues (End of Life Vehicle act for recycling 95% of product), Asset management etc.

RFID can bridge the last mile between the actual products and the PLM solutions. Manual errors and delay in information sharing can be avoided. RFID tags can store the tag identification number, which RFID readers can read and send directly to PLM systems, to enable access as well as storage of the necessary information there.

Some PLM players have already started developing solutions with RFID. Detailed analysis of RFID technology and current PLM solutions states that there is a huge opportunity for PLM-RFID combined solutions that can bring tremendous benefit to the organisations.

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About the Author

Rajaravisankar Shanmugam

The author has been working with TCS for the past five years. He completed his Bachelor of engineering (Mechanical engineering) from REC Trichy, India and has done his MBA from S.P. Jain institute of management, Mumbai, India. Being an expert of PLM, he has worked for international customers in solving PLM issues. His interest lies in analyzing new technologies.

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Introduction

The need for customer safety and environment friendly products is increasing every year and new legislations and acts are enforcing companies to track their product throughout its lifecycle. In the current scenario, ensuring the right component gets into the product is not enough; it is necessary to track it till its last stage. This paper analyses such critical business issues, its impact for the companies and how RFID combined with PLM solutions can solve those issues.

What is Product Life Cycle Management?

CIMdata defines Product Life Cycle Management (PLM) as a strategic business approach that[1]:

- Applies a consistent set of business solutions that support the collaborative creation, management, dissemination, and use of product definition information
- Supports the extended enterprise (customers, design and supply partners)
- Spans from the concept to the last stage - the life of a product or plant
- Integrates people, processes, business systems, and information

Three core or fundamental concepts of PLM are:

1. Accessing and using product definition information in a universal, secure, and manageable manner
2. Maintaining the integrity of the product definition and related information throughout the life of the product or plant
3. Managing and maintaining business processes used to create, manage, disseminate, share and use the information.

While information includes all media (electronic and hardcopy), PLM is primarily about managing the digital representation of information.

What is Radio Frequency Identification?[2]

Radio Frequency Identification (RFID) is a generic term for technologies that use radio waves to automatically identify people or objects. There are several methods of identification, but the most common is to store a serial number that identifies a person or object, and perhaps other information, on a microchip that is attached to an antenna (the chip and the antenna together are called an RFID transponder or an RFID tag). The antenna enables the chip to transmit the identification information to a reader. The reader converts the radio waves reflected back from the RFID tag into digital information that can then be passed on to computers that can make use of it.

The big difference between the bar codes and RFID is that bar codes make use of line-of-sight technology, that is, a scanner has to “see” the bar code to read it, which means people usually have to orient the bar code towards a scanner for it to be read. Radio frequency identification, by contrast, does not require line of sight. RFID tags can be read as long as they are within the range of a reader. Bar codes have other shortcomings as well. If a label is ripped, soiled or falls off, there is no way to scan the item. And standard bar codes identify only the manufacturer and product, not the unique item.

Critical Issues in Managing Product Lifecycle

For every product, its lifecycle starts from the conceptual stage, then design, development, manufacturing, delivery and ends up with its retirement/ decommissioning. Due to increased awareness on customer safety and environmental awareness, new legislations have been created to ensure that the companies are taking care of all aspects of the product life cycle. Five critical issues, which have been discussed in the following section, have been identified.

[1] CIMData Inc
[2] RFID Journal

1. Product Recall Issues

Pain area 1 - Tracking and tracing the raw materials

The new **EU legislation on food safety**[3] , which came into force in January 2005, states that food manufacturers have to be able to show that they can trace products right through the food chain. It means keeping track of raw materials to shipping a final product, and everything in between. It enforces traceability of materials that are coming into contact with the food at all stages of production and distribution.

Industry Size[4]

European food and drink industry

Small and medium size companies

No of Companies = **13,400**
Total Turnover = **€ 600 billion**

Large size companies

No of Companies = **2600**
Total Turnover = **€ 600 billion**

This shows that there is a large demand for solving this issue.

Possible Solution through PLM-RFID

Concept

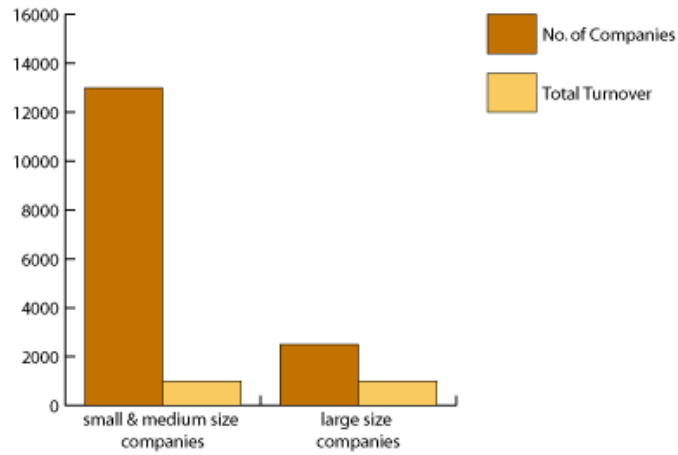
The complete product related data can be stored in the PLM system. Each and every raw material that goes into a product and the conditions and processes followed will be stored. At any point in time, when there is a need to identify all the products that have a particular raw material, all those products can be traced easily.

Steps Taken

Agile officials report that a private label food company that uses meat in its soup turned to the vendor for advice shortly after the Canadian mad cow scare in 2002, because it wanted to ensure that it could identify which of its products were made with beef from Canada vs. beef from the U.S. The PLM software can record the country of origin in the product record, so the food company, which Agile would not identify, can run reports to track down not only the origin of the meat used in the soup, but also that of other items like carrots and potatoes.

[3] "Traceability" is an important part of current EU food legislation as it sets out a system to identify and trace all stages of food production. Traceability in food production was established in Article 18 of Regulation (EC) No 178/2002. This is an important safeguard in the event of any possible contamination. The proposed Regulation applies the same principles to the production of food contact materials so businesses in the sector can identify where food contact materials and substances used in their manufacture have come from and where they have been supplied to.

[4] CIAA report highlights the fact that the European food and drink industry appears to still be diversified and fragmented. More than 90 per cent of food enterprises are small and medium size companies, accounting for almost the half of the turnover - estimated production value of € 600 billion.
With 26, 000 companies employing close to 3 million people, it is essential that a clear picture of the general health of the industry is understood.



Pain Area 2 - Early identification of Product Failures

How to ensure that the early product repairs/ failures are identified as soon as possible?

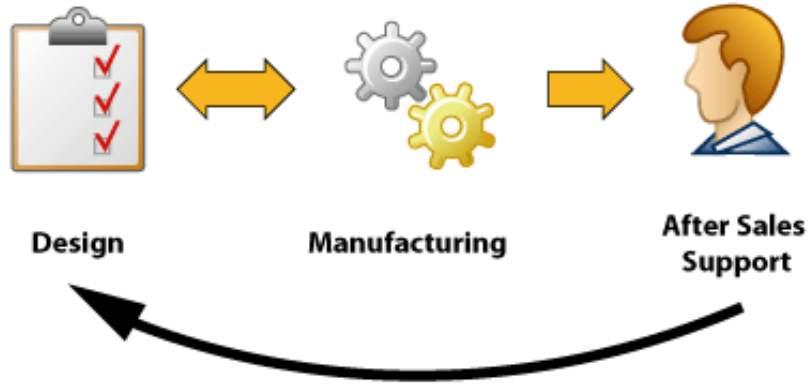
1) TREAD Act has rapid response requirements that require companies to aggregate data quickly to provide information when there are death or serious injury accidents.
2) Due to increase in competition, companies are focusing more and more on introducing innovative products in the market as soon as possible. At the same time, this increases the need for handling potential product failure related issues. It is necessary to take care of the product recall after its release and identifying it as soon as possible to protect the company's image and customers from potential risks.
3) Gap between the design team and the after sales support team – Real time information about product failure related issues will help the design team take care of those issues from its next versions as well as understand the consumer usage of the products.

Over the last five years, the US Consumer Product Safety Commission has recalled an average of 321 products per year. This number and the associated costs have continued to increase in recent years. Each recall can involve hundreds of thousands of dollars. Data for 1990-1996 for the United Kingdom shows an average of 42 products recalled per year, with the average cost of each being £39,000. Information from the United Kingdom's Department of Trade and Industry indicates that the number of recalls continues to rise each year. Out of this, 59% of product recalls are due to poor design. Average cost for product recall increases from £20000 to £80000 as the product reaches more and more customers. So, early identification of product failure can save more money as well as the brand image.

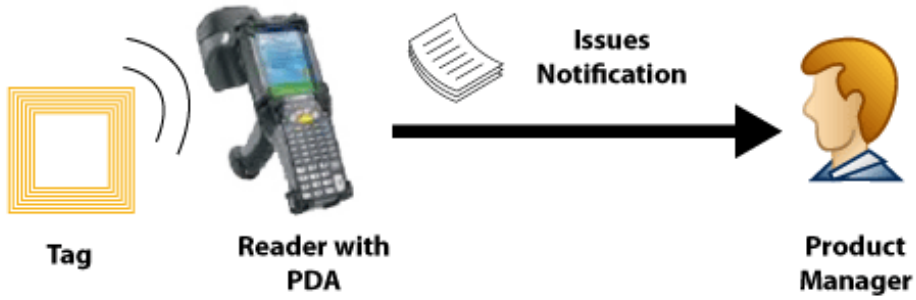
Possible Solution through PLM-RFID

Concept

There are many companies, which are using the PLM system in their product plan, design and development. However, most of the times, all this information is restricted in the manufacturing stage and there is no feedback mechanism about the product failures. If the current PLM solutions can be extended to after sales service support area, then the product failure details, and the issues related with them can be recorded, which will be valuable for the product development team.



If the product has the RFID tag, then it becomes easy to identify the product and if the product failure details can be routed to the corresponding product manager in real time, then it will be easy for the organisation to respond to the issue. If the product needs to be recalled, it will be identified at the first instance itself. This will result not only in huge monetary saving for the company but also protect the company image. Timely response to the customer issue will win back customer confidence in the company.



Normally, whenever a product fails/ meets with an accident, the field service engineer will inspect the product. Here, the service engineer should capture the tag ID through RFID reader and enter comments on the product in the PDA. The comments and RFID tag number will be sent directly to the PLM system to request design verification. This design verification request will be done only for early failures. After the initial phase, the product related issues will be just stored in the PDM system. All these captured information can be analysed and used for the development of the new product. This real time information will narrow the gap between the design team and the after sales service team. This feedback information closes the loop that starts from the design of the product-to-product release and feedback to the design team.

2. Right Part at Right Place at Right Time

Issue: Information is available to everyone. But how to ensure that it is used?

Pain area 1- Different components in the same assembly line
In the automotive industry, where just in time, and just-in-sequence delivery requirements are common, automakers and their suppliers should identify sub assemblies to ensure they are installed in the correct chassis. It is necessary to make sure that the right component gets into the right product at right time.

Pain area 2- Last minute design changes
When an organisation is working on concurrent engineering, the last minute design changes should be reflected in the manufacturing. Even though the information is available in the PLM systems, it is subject to the operator's response to the information.

Pain area 3 - Sequence load and installation errors
Manufacturing operations that require sequencing or build-to-order production rely on item-level identification to ensure the right components are added to assemblies.

As mentioned earlier, in the automotive industry, just in time and just-in-sequence delivery requirements are common, which requires that automakers and their suppliers' needs should identify sub assemblies to ensure correct chassis installation.

By preventing sequence loading and installation errors, the company can avoid the high cost of product rework.

Possible Solution through PLM-RFID
Concept
PLM system has stored all component details and their tag numbers. These components are attached to another final assembly to make it a final product.

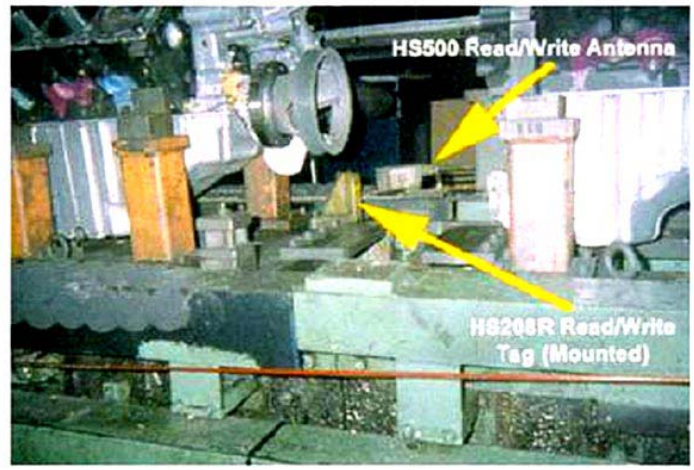
Every component has a tag number as well as the final assembly. If the RFID reader can read the tag ID from the assembly as well as the components in the assembly line, then it becomes easy for the back end system to check both the numbers and ensure that the right component is on the assembly line, otherwise it will set an alarm.

Steps Taken

Ford Motor Co. is using RFID tags to streamline its Essex engine plant in Windsor, Ontario.

At Ford's Essex plant in Windsor, Ontario, Escort Memory Systems tags carry all instructions needed to assemble each engine, as well as all test data accumulated during manufacturing.

Similarly, if the component tag has the EPC code, the reader can ensure that the right component gets into the right assembly by checking the tags of the component and the assembly against the PLM database. This will be very useful in just-in-time manufacturing where the same assembly line can be used for different products.



3. Service and Maintenance - Repair Shops

Issue

In maintenance and repair activities, it is necessary to identify the component so that it can be serviced as defined in the PLM. However, identifying the right component is an issue. Most of the time, there is a huge gap between the service people and the component suppliers.

Pain Area 1 – Wrong Identification and Record-Keeping Errors

Wrong identification and record-keeping errors could potentially cost millions of dollars in unnecessary replacement costs. In the aviation industry, for example, if positive identification and lifetime service records are not available for a part, it can not fly.

Pain Area 2- Servicing Multiple Versions of Same Product

When companies are upgrading their products frequently and releasing multiple versions of products, it becomes complex for the service and maintenance shops to identify the product and service them better. Companies manufacturing long lead items – Aviation and shipping industry in particular, are incurring problems in repairing the items. Even though much information is available to the repair shops, wrong identification of the components causes immense rework and wastage of time and money.

Possible Solution through PLM-RFID

Concept

Engineers should store all the documentation related to the parts like how to repair, quality checks, checklists, and tests to be conducted in the PLM system. As soon as the RFID reader reads the tag ID, it will be sent to PLM system to pull out the product information with drawings and information, such as how to repair. Using the information, the service provider can service the part easily without any confusion. If there is any clarification needed, it will be routed through the PLM system to the respective engineers. Storing this information in PLM might serve as a reference for future repairs.

4. End of Life Vehicle Process[5] – Vehicle Dismantlers

Issue

The EU End-of-Life Vehicle (ELV) Directive[6] is a legislation enacted by the European commission to encourage re-use, recycling and recovery of ELV and ban certain hazardous materials. This is a sensitive issue for the automobile industry. It mandates 95% recovery of ELV. An additional key requirement of the ELV Directive is "free-take-back" of ELVs, which mandates vehicle owners to deliver ELVs to authorized treatment facilities (ATF) at no additional cost.

[5] Forrester report on "Recycling recovers Auto Profits"

[6] The legislation sets forth requirements for 15 Member States to set legislation to encourage re-use, recycling and other forms of recovery of ELVs and their components and ban certain hazardous substances

One of the key requirements to recover such a high percentage is to identify parts and understand what constitutes each and every of part and how it can be recycled. This process normally happens 10-20 years after the vehicle is manufactured.
By 2007, producers will pay 'all or a significant part' of the costs of treating negative or nil value ELVs at treatment facilities.

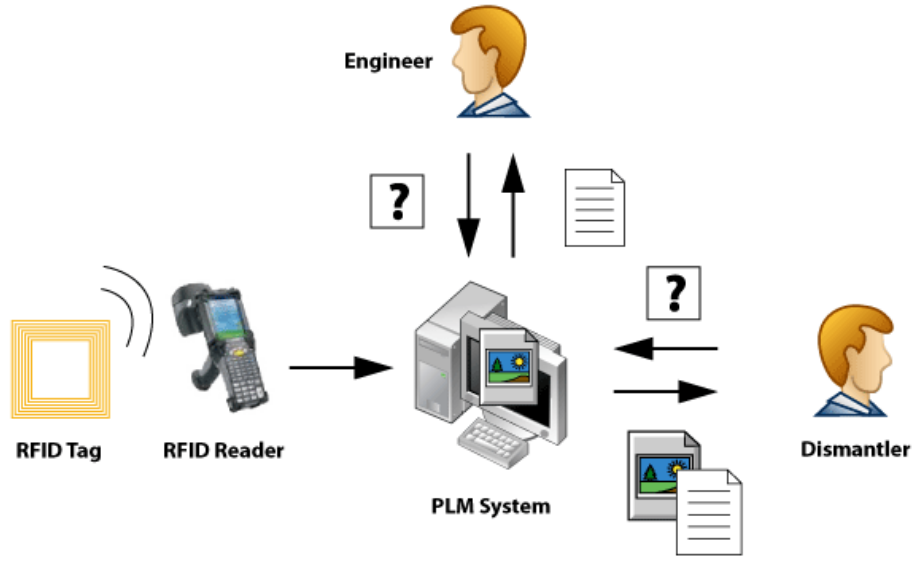
In the European Union, as of May 2004[7] , there were over all 21 car manufacturers and 98 different car models. Due to increase in competition, companies are introducing many new models every year. The increase in number of models, new parts and components increases the complexity of identifying components for recycling and achieving the 95% mandatory recovery.

Possible Solution through PLM-RFID

Concept

ELV directive has assigned the responsibility of achieving 95% recovery of ELV to car manufacturers. To achieve 95% recovery, it is necessary that the dismantler know each and every component of the vehicle and how to recycle it.

Through PLM systems, engineers can decide how to recycle the part and store that information in the design stage itself. For all other components, the information can be stored with the Product definition details. If this information can be available for the dismantlers, then it is possible to achieve maximum recovery of ELV.



Information flow

RFID can help in correctly identifying the components and parts of a vehicle, thus avoiding wrong identification and other errors. The marriage between RFID and PLM can help to find a viable solution. If the parts are manufactured with tags in it, dismantlers will read these tags and consult PLM to find every item, what it is made of and how to recycle it. Then, the dismantler's job is to simply follow the instructions.

It is aimed at decreasing more than 10 million tons of waste generated by about 12 million cars that become ELVs each year. Approximately 25 percent of each ELV currently goes into landfills. The ultimate goal is to reduce this to a maximum of 5 percent by 2015. In order to achieve these targets, Member States must have systems in place no later than 2007.

[7] http://europa.eu.int/comm/competition/car_sector/price_diffs/

5. Asset Management

Issue

Identifying the difference between the old component and the new component will help reduce the equipment replacement time and eliminate rework and other issues. Normally, there are differences between different versions of the same equipment. Therefore, it is necessary to keep the data and configurations of the old equipment, compare them with the new one, understand the difference and configure tools and software set-ups, and sensor accordingly.

Possible Solution through PLM-RFID

Concept

PLM asset management solutions can keep track of the key equipments and their replacement. If RFID tags can directly talk to the PLM solutions, then the difference between the old and new equipments can be automatically identified. Instead of setting up all software, sensors and all other set-ups, identifying the difference in set-ups for the equipments will save time.

Read-write RFID tags can permanently and securely store an item ID number and reserve additional memory for data that can be written and updated later. Maintenance, asset management and warranty applications could benefit from this capability, if item tags were regularly updated with inspection dates, service codes, or even data from sensor readings. These applications go beyond the basic requirement of providing tracking and identification and can provide true value and cost savings to the enterprise.

Steps Taken

Paramount Farms[8] and ODFL rely on RFID to manage their most expensive and time-sensitive assets. RFID is so adaptable that many other types of businesses can use it to improve the tracking, availability and utilization of their valuable assets, whether tools, equipment, materials or work in process machinery. Asset tracking holds excellent ROI potential that virtually any company can enjoy.

Enterprise asset management from the mySAP™ Product Lifecycle Management (mySAP PLM) solution, is designed to help companies run 24/7 operations cost-effectively and reliably by effectively managing mission-critical physical assets such as machinery, power plants and vehicle fleets over the complete life cycle. To extend the solution's reach to service technicians safeguarding equipment in the field, SAP closes the business process loop to the backend system through the RFID-enabled mobile solution SAP® Mobile Asset Management and the SAP Auto-ID Infrastructure.

8 Intermec whitepaper- Beyond the Tag

Analysis of the Benefits

The following table gives a snapshot of the benefits for the companies if they implement PLM solutions and RFID in place.

Used Where	Benefits
In Manufacturing	• Ensures right product and right place and at right time • Reduction in rework • Can produce different products in the same assembly line • Zero sequence load and installation errors • High response to design changes • Ability to track and trace raw materials • Compliance to EU Food Safety regulations
After Sales	**For the Design Team** • Real time **feedback** to the design team on product failures/ issues • Early identification of product failures and need for product recall • Cost saving due to early product recall identification • Better control over new product development and innovation
	For Repair Shops PLM system should have information on how to repair each and every component and replace that. The benefits are: • Quick and better service • Zero chance for misidentification • Zero record-keeping errors • Service for **Multiple versions** of the product without any difficulty • Compliance to **TREAD** Act
	For Junkyard PLM system should have information on how to **dismantle**, **recycle**, **reuse** and **recovery**. The benefits are: • Compliance to environmental regulations • Compliance to End of Life Vehicle directive legislation • Ability to reuse the components • Cost savings
For Plants / Large Factories	• Asset management • Ability to manage the key assets • Reduction of replacement time • Reduction of production idle time

Analysis on Issues and PLM-RFID Solutions

Issue Category	Issues	Solution Details	Comments
Product Recall Issues	Tracking and tracing the raw materials– EU food safety legislation **Impact:** Around 2,600 large size companies with total turnover of 600 billion euro are immediately affected.	Raw material information with their origin in PLM might solve this issue. RFID tags can be used to track the raw materials as well as the final products	Agile system has already implemented
Early Identification of Product Failures	Early identification of product failures **Impact:** Every product recall cost around £20,000 to £80,000 based on delay in product failure identification. Every year, 42 product recalls (as on 1996) in UK and 321 recalls in USA.	Real time notification to product manager about the product issues through RFID tag, reader, PDA and PLM system	Easy to implement. Minor changes are required in PLM system. Effective solution.
Right component at right product	• Different components in the same assembly line • Last minute design changes • Sequence load and installation errors	Assembly tag ID and component tag ID can be compared with PLM system product information.	Ford has implemented similar solution without PLM. Same can be done for companies who have implemented PLM.
Service and Maintenance- Repair shops	• Wrong identification and record-keeping errors • Servicing multiple versions of same product	RFID tag ID will help for correct identification of the product and it can directly talk to PLM system to pull out the repair and service information for that particular product.	Need to develop best of breed PLM solution that can be used for this area.
End of life vehicle process – Vehicle dismantlers	Every part of the vehicle should be identified after almost 10 to 12 years and 95% of the weight of the vehicle needs to be recovered. **Impact:** 21 car manufacturers in EU are affected	RFID can help in identifying the parts of the vehicle. If product details like what it is made of, how to dismantle it, and how to recycle it etc.	Need a best of breed solution for this one incorporating all the processes etc
Key Asset Management	• Avoiding the idle / shut down time due to key asset failures in product manufacturing. • Unnecessary wastage of time and money in replacing the old equipments.	All the equipment details like set-ups, hardware, software components etc should be stored in PLM system and RFID can help in identifying the failure or end of life of the equipments	mySAP PLM has already come up with RFID enabled enterprise asset management system.

Challenges

The following challenges have been identified in the implementation of the PLM system:

1. Companies perceive PLM solutions are yet to mature
2. Industry view about RFID:
   "About 50% of all RFID tagging pilot projects conducted worldwide have already been written off as failures and most of the rest have yielded indifferent results according to the analyst firm Meta Group" – Computer weekly, April 20
3. Cost of the tags is more than $1 for active and high frequency tags
4. Size of the tags is greater than 1.5 inch for high frequency tags
5. Privacy issues - California state is discussing this issue. California state senator Debra Bowen introduced pre-emptive legislation to control the use of RFID technology in the California senate in March 2004. After a month, the body approved an amended bill on a 22-8 vote. Debra Bowen's main goal, as she says, is to prevent retailers from invading people's privacy.
6. No industry wide standards
   EPCglobal leads the development of industry-driven standards for the Electronic Product Code™ (EPC) but still has established no clear standards to guarantee the interoperability between EPC tags and readers made by different vendors.
7. Pessimism about marriage between two new technologies

Warnings

"Without collaboration and standardization, RFID will be nothing more than a very expensive data collection tool" –Mark Roberti, Founder & Editor, RFID Journal

"It is also complicated, requiring culture, process, and technology change. Every vendor sees RFID as an opportunity to sell right now, and it might not be the right time for you to buy." – Cautions AMR Research

Conclusion

Even though, both the technologies are new, they provide opportunity to all the companies to leverage the best they can. PLM is not a single solution. It is a concept and there are many solutions available, which need to be implemented, based on the need/ pain area of the company. So, proper valuation and selection of the PLM solutions will help for sure. With legislations such as TREAD act, EU directive on food safety, and ELV directive in EU, it becomes necessary to keep the PLM solutions in place so that products can be traced. RFID as a technology has tremendous potential to solve key issues. Its success depends on what purpose it has been used for. In key asset management and other high value items, a tag cost of $1 is not a big issue. To conclude, a PLM and RFID combined solution has tremendous potential, which is yet to be leveraged for organisational benefits.

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TCS RFID Solutions

TCS RFID solutions group focuses on conceptualizing, designing and delivering RFID based identification and tracking solutions. These solutions build upon TCS domain experience, enterprise applications expertise and systems integration capability with skills and assets in core RFID technology (hardware/sensing technology) and middleware. Taking a business and processes perspective, TCS focuses on using technology for process improvements and elimination of customer's pain areas.

About EIS Business Unit

Engineering and Industrial Services (EIS) is one of TCS's strategic businesses that provides single-window solutions globally to help clients maximize efficiencies in innovation, operations, and capital and asset management. We do this by using best-in-class technologies, rich and robust processes, and an extensive range of competencies. The business offers a wide spectrum of engineering services and solutions, covering product development, process design, industrial automation, electronics and embedded systems, and enterprise asset management.

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Tata Consultancy Services (TCS) is among the leading global information technology consulting, services and business process outsourcing organizations. Pioneer of the flexible global delivery model for IT services that enables organizations to operate more efficiently and produce more value, TCS focuses on delivering technology led business solutions to its international customers across varied industries.

For more information contact

T S Rangarajan
Head, RFID Solutions
Tata Consultancy Services
17, Cathedral Road
Chennai 600 086, India

Phone: +91-44-5550-4489
Fax: +91-44-28117325

ts.rangarajan@tcs.com
www.tcs.com/rfid

Ranjeet Pawar
Engineering and Industrial Services
Business Unit
Tata Consultancy Services Limited
11th Floor, Air India Building
Nariman Point
Mumbai 400021

Phone: +91-22-5550 9428
Fax: +91-22-5550 9455

corporate.engineering@tcs.com
www.eis.tcs.com

TATA CONSULTANCY SERVICES