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# A COMPARISON OF IMPLEMENTATION ISSUES AND STRATEGIES FOR RADIO FREQUENCY IDENTIFICATION TECHNOLOGIES BETWEEN THE U.S. MILITARY AND PRIVATE SECTOR ORGANIZATIONS

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*The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the Air Force, the Department of Defense (DoD), or the U.S. Government.*

## ABSTRACT

The purpose of this research was to study the implementation of radio frequency identification (RFID) technologies used to track equipment and supplies. Current implementation issues and strategies for future use were collected from leading edge organizations from the military and private sector. A formal comparison found both similarities and differences between how industry and the Army are implementing and using RFID technologies in their supply chains and logistics networks. This article focuses on these similarities and differences, to include a gap between the Army and industry regarding RFID tag use and implementation, and a difference in the overall focus of how RFID tags are or plan to be used in both environments.

## INTRODUCTION

Some civilian business practices, such as the utilization of radio frequency identification (RFID) tags and just-in-time (JIT) inventory, were used for the first time by the United States

Army in a major conflict during Operation Iraqi Freedom (OIF). RFID tags were attached to containers and pallets in every sustainment shipment entering and exiting the area of operation. Vendors applied tags prior to initial shipment, or tags were added to pallet, bins, or

containers at the aerial ports or at distribution centers. From January to June 2003, over 25,000 containers were tagged (Stewart, 2003). Although RFID tagging and some other Automated Identification Technology applications were somewhat successful during OIF, the logistics network still suffered some significant problems, to include asset visibility and ineffective theater distribution.

In October 2003, the Department of Defense (DoD) established a policy for the use of RFID tags within the DoD. The policy requires the DoD to develop business rules based on the results of initial RFID projects, and requires suppliers to place passive RFID tags on the lowest part, case, or pallet possible by January 2005 (Wynne, 2003). An "RFID-enabled DoD supply chain will provide a key enabler to the asset visibility support needed by our warfighter" (Wynne, 2004). To prepare for the implementation, the DoD is partnering with industry and leveraging commercial sector initiatives (Estevez, 2003).

Similar to the DoD's initiative, Wal-Mart Stores, Inc., announced in June 2003 it will require its top 100 suppliers to attach RFID tags on all shipping crates and pallets destined for Wal-Mart by January 2005 (Brewin and Vijayan, 2003). Wal-Mart is the world's largest retailer, and has extensive influence over industry practices. The DoD is even larger, and has a supply chain unmatched in diversity by any commercial industry (Gilligan, 2004). Although both are implementing RFID technologies, it is important to note that retailers and the DoD may have different objectives for RFID. William Phillips, head of IBM's defense industry consulting business notes that "DoD requirements are similar to industry's at a high level, but as you drill down, DoD's focus is on readiness...its supply chain is more widely distributed and fluid" (Jackson, 2004).

The initial purpose of this research was to determine if the implementation of RFID technologies to track equipment and supplies could be effectively used in a wartime environ-

ment by the Army's logistics network in order to improve asset visibility. As the research progressed, similarities and differences between how industry and the Army are implementing and using RFID technologies in their supply chains and logistics networks became apparent, and this article focuses on those similarities and differences. It is hoped that in areas where the Army has shown advanced practice, this could be helpful to industry; and in areas where industry has solutions, the Army could benefit. The purpose of this study was to provide a preliminary characterization of the similarities and the differences between organizations in these two distinctly different environments, who share common problems and issues. It is believed that the results of this study highlight interesting areas for further investigation.

## METHODOLOGY

This research used a grounded theory methodology to address the initial investigative and research questions, and employed content analysis to assist in the identification of similarities and differences between civilian industry and the Army. How the Army employed RFID technologies in its logistics network during the combat phase of OIF, and the associated lessons learned, were researched as part of the literature review. Academic literature available on the subject was somewhat limited, due to the newness of the topic, and the data for the literature review were extracted from DoD and Army manuals and regulations, OIF articles and lessons learned, and DoD briefings.

Civilian companies currently using or implementing RFID technologies in their supply chains were initially identified during the literature review. First, Auto-ID Center Sponsors were identified. As sponsors, these companies have shown their commitment to the implementation of RFID tag technologies. Global companies with diverse product lines and extensive supply networks that were also sponsors were then identified, as their logistics networks closely mirror that of the Army. Interview candidates were then selected from

companies that met both criteria and that appeared frequently in RFID literature. Eight companies were selected as interview candidates, and five companies agreed to participate. Four of the companies were global suppliers, and one was a global retailer. Based upon data collected during the literature review regarding RFID technology implementation, no global shipping companies were interviewed. This must be kept in mind as the comparisons are made, as it represents a difference in operational focus on the military side vs. private sector.

To discover the similarities and differences regarding the use and implementation of RFID tag use and implementation, five investigative questions were researched:

1. How is RFID technology being used by civilian companies to run their supply distribution network?
2. What processes are employed by civilian companies to successfully implement RFID tags to help achieve asset visibility in situations similar to the Army?
3. What logistical problems did the Army encounter in their overall supply distribution network in Iraq during the combat phase of OIF?
4. How did the Army's logistics network employ automated identification technology (AIT) during the combat phase of OIF?
5. What problems did the Army's logistics network encounter with the different AIT technologies during the combat phase of OIF?

After each of these questions had been thoroughly researched, a sixth question: "What similarities and differences exist between the civilian companies' and the Army's implementation and usage of RFID tags?" was answered. As previously noted, this article focuses on the answer to the sixth investigative question.

A standardized, open-ended interview approach was used to conduct the interviews, and the interviews revolved around seven, standardized questions. This interview method facilitated data organization and analysis, and eased response comparison (Patton, 1990).

## RESULTS

The original focus of this research was to answer the question: How can the business practice of using RFID tags to track equipment and supplies be effectively utilized in a wartime environment by the Army's logistics network? To answer this question, current business practices associated with the use of RFID were researched, and a study was conducted regarding how the Army used RFID during OIF, and what problems the Army's supply distribution network experienced during OIF. Having collected this data, similarities and differences regarding RFID use in the private sector and in the Army and DoD were discovered.

Table 1 outlines the common issues associated with the use of RFID by civilian industry, and the Army's use of RFID tags during OIF. Similarities include concerns associated with the new technology, as well as the support required from suppliers to actually implement and use the technology on a day-to-day basis.

Differences between the Army's and industry's use of RFID tags are outlined in Tables 2 and 3.

Table 2 focuses on areas where industry is unique in their use of RFID technologies in the supply chain, and Table 3 highlights areas where the Army is unique, based on their use of RFID tags during OIF to support their logistics network.

### **RFID Tag Use and Implementation Within the Supply Chain**

A major difference discovered during the study was the current status of the use and implementation of RFID tags. The DoD used RFID

**TABLE 1  
COMMON CONCERNS<sup>1</sup>**

	Civilian Response (%)	
Improved customer service	80	Important aspect of RFID tag implementation for both the Army/DoD and industry. Improved inventory and asset visibility should both lead to improved customer service.
Improved productivity	60	Personnel productivity improved during OIF at sea and aerial ports as a result of the RFID tags. Productivity is highlighted as a potential improvement by industry.
Reduced assets in the supply chain	40	Based on improved demand visibility, assets in the supply chain should be reduced through the use of RFID tags. This was an issue during OIF, since supplies were often "pushed" forward due to lack of visibility. Reducing assets in the supply chain
Lack of interoperability between systems	20	Highlighted as a problem in OIF, lack of interoperability is also mentioned as a potential concern within industry.
Concerns regarding tag read rates	20	Accurate read rates are vital for both civilian and military use, although there is an assumption read rates will improve as the technology improves.
Concerns regarding reliability of technology	20	The use of RFID tags in the supply chain is a new application of the technology; reliability concerns are shared by both industry and the Army/DoD.
Support required by retailers/suppliers	10	Supplier support is essential to implementation. Suppliers must purchase and apply tags to cases. Although the DoD applied tags to pallets as required during OIF, the

<sup>1</sup>Total percentage of civilian responses noted/identified in literature as military concern.

**TABLE 2  
INDUSTRY UNIQUE ISSUES<sup>1</sup>**

Field testing RFID tag applications	80%	Industry is <i>field testing</i> the use of RFID tags.
Reduce out of stock items	80%	Considered a major advantage of RFID tags by industry. Although a useful Army and DoD application, out-of-stock reduction is not the current focus.
Improve inventory management	60%	Interviews with industry personnel showed the primary initial focus will be on using RFID tags to improve inventory management.
Cost	60%	Industry is concerned about the cost associated with RFID tag use and implementation. Cost was not highlighted during the literature review as a factor for the Army/DoD.
Tag application	20%	Suppliers apply tags by hand, but this process needs to be automated due to efficiency/time constraints. Tags were applied by hand to pallets and containers during OIF, but the requirement and the impact was <i>minimal</i> .

<sup>1</sup>Total percentage of industry responses noted

**TABLE 3**  
**ARMY UNIQUE ISSUES<sup>1</sup>**

Improve asset visibility	100%	Army/DoD focus is on using RFID tags to improve asset visibility for the warfighter.
Using RFID tags in the field	100%	Army/DoD proved the technology by tracking pallets and containers from the U.S. to the AOR during OIF.
Bandwidth/communication infrastructure	80%	Bandwidth/communication infrastructure in OIF could not support the requirement to link logistics information systems. Limited asset visibility even with RFID tags. Should not be an issue in civilian industry.
Insufficient transportation for Army supply forces	60%	Adequate transportation in-theater not always available during wartime to move supplies. Negatively impacted ability to move supplies.
Supply line security	60%	Supply line security was a major issue during OIF, and is unique to the DoD's wartime logistics network.
Long and dynamic supply lines	60%	Army & Marine units were continually on the move during OIF. Changing destinations/lack of existing routes and roads for transport of goods impacted supply lines, and complicated the use of RFID tags.
Set-up/take-down of RFID readers	20%	Moving supply lines during wartime requires set-up and take-down of readers at each location. Generally, set-up occurs once in industry.
Correct placement of RFID readers	20%	With each move during war, correct placement of the RFID readers must be determined prior to set-up. RFID reader placement generally remains static after initial set-up in industry.
Power source/power source maintenance	20%	Power for RFID readers must be supplied by gas or battery-operated generators during war. Power source is not an issue in industry.
Reader/power source security	20%	RFID reader and generator power sources (batteries and fuel) are subject to pilferage during war. Should not be a major factor within industry.
Product variation	20%	Army and civilian companies both have extensive inventory, but wartime supplies are generally considered more diverse/extensive.
RFID tag security	20%	Although privacy issues are a concern with industry, the DoD must determine how to ensure RFID tags don't provide item identification/troop location to the enemy— <b>lives are at stake during war</b> .

<sup>1</sup>Total percentage of OIF lessons learned responses noted

tags to successfully track pallets and containers shipped from the United States to the Area of Responsibility (AOR) during OIF. In addition, the Army used RFID tags to track supplies from sea and aerial ports to troops in the field. Although tracking supplies with RFID tags in the field was not as successful as from the United States to the ports, tags were applied to all containers and pallets. In contrast, the industry interviews highlighted that a limited number of civilian companies are currently field testing RFID tags, and the technology has yet to be implemented company-wide. Implementation will expand based on the results of the initial field tests, but the results are still unknown.

This finding was interesting because the researcher believed the DoD adopted RFID tags based on a technology proven by industry. The research shows that the DoD is actually parallel or ahead of industry regarding the implementation and use of RFID tags in the supply chain, although the focus for use is somewhat different.

#### **RFID Tag Implementation Focus Within the Supply Chain**

Another major difference discovered during the study was how RFID tags are being used, or plan to be used, by the Army/DoD and industry. The DoD's current focus is to use RFID tags to

improve asset visibility, both to and from the AOR and within the AOR. As highlighted earlier in this study, RFID usage was mandated by the DoD with the belief that an RFID-enabled supply chain "will provide a key enabler to the asset visibility support needed by our warfighters."

In contrast, industry is focused on using RFID tags to improve inventory management and reduction of out-of-stock items at retail. As highlighted earlier, the civilian sector is not yet using RFID-tags to improve inventory management, but is testing the technology. Assuming the tests are successful, RFID tags will initially be applied to improve inventory management.

This finding was interesting because the researcher assumed the DoD mandated RFID implementation based on current industry use of the technology. On the contrary, not only is the DoD parallel or ahead of industry regarding use of the technology, the focus is different. The DoD used RFID tags to improve asset visibility during OIF, and is expanding implementation with the goal of improved asset visibility within logistics networks. Industry has a different focus, and plans to initially use RFID tags to improve inventory management and overall shelf stockage.

### **The Army's Wartime Logistics Network**

In addition to the two major discoveries highlighted above, the majority of the differences found during the research are related to issues associated with the Army's wartime logistics network and supply line. Each of these areas was highlighted in the OIF lessons learned or after action reports and relate to complications associated with moving supplies in a wartime environment. Although bandwidth, transportation, security, and dynamic supply lines do not relate directly to the use of RFID technologies, they have a major impact on the logistic network's ability to communicate and move materials, with or without RFID tags. In addition, dynamic supply lines impact RFID tag effectiveness based on the constant requirement

to set-up and take down equipment, and to provide a power source. Civilian companies do not have to manage these difficulties in their global supply networks, or if they do, not in the same scope or scale.

## **CONCLUSIONS**

During the research, two interesting findings were discovered. First, the research revealed a major gap in RFID tag use and implementation between the Army/DoD and civilian business. The research showed *the DoD is parallel or ahead of industry regarding the implementation and use of RFID tags in the supply chain*. The DoD successfully used RFID tags to track pallets and containers shipped from the United States to the AOR during OIF, and the Army used RFID tags, to some extent, to track supplies from sea and aerial ports to troops in the field. In contrast, civilian companies are still field testing RFID tags, and the technology has not yet been implemented beyond testing.

Second, *the overall focus of how RFID tags are or will be used within the Army/DoD and civilian business is different*. The DoD's current focus is to use RFID tags to improve asset visibility, and this was practiced during OIF. In contrast, industry plans to use RFID tags to improve inventory management and to reduce out of stock items. Although asset visibility may become a focus area in the future, initial focus will be inventory management.

In addition to the two areas highlighted above, a number of similarities and differences exist regarding how industry and the Army/DoD are implementing and using RFID tags. Both industry and the Army have improved or plan to improve productivity and customer service with RFID tags, and they share similar concerns regarding reliability, supplier support, and system interoperability. Despite this, the Army is unique from industry in its use of RFID tags for several reasons. Bandwidth and supply line security are two issues that impact RFID tag usage, as is long and dynamic supply lines. The supply line has a direct impact on the use of

RFID technology, as it impacts the set-up and take-down of RFID readers, the placement of RFID readers, and it requires a secured power source.

The findings, particularly with respect to the focus of private sector RFID implementation, must be considered preliminary. This research identified some areas of potential difference between DoD and civilian implementation issues and strategies. However, a larger scale study would need to be performed. Without a broader analysis of industry practice, it is difficult to put much confidence in the ability of the small number of participants in this initial study to

represent the intent or experience of the industry as a whole. However, it is believed that this small effort has identified some potential areas of difference which, if validated and explored further, could lead to greater progress and collaboration between both sectors, leading to improvements for organizations in both. The findings also emphasize how important it is for the DoD and industry to work together as each tests and implements RFID technologies. Since the organizations have different focuses and implementation plans, each can learn from the other regarding testing and use, and can aid in further development, use, and implementation.

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