

## MULTI AGENT RFID PROCESS IN PROJECT CHAIN MANAGEMENT

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### ***Abstract:***

Project charter is perhaps the most important document included in the Project Management plan. It provides a preliminary outline of the project's scope, objectives and identifies the participants in the project. The schedule plan is responsible for bringing project time, cost and quality under control and links resources, tasks and time line together. Once a Project Manager has list of resources, work breakdown structure (WBS) and effort estimates, he is ready to go for planning project schedule. Schedule network analysis helps Project Manager to prevent undesirable risks involved in the project. Project Chain Management (PCM) and Radio Frequency Identification (RFID) are key elements of schedule network analysis.

This paper presents a model of Multi-Agent System (MAS) dedicated to the PCM through RFID. It describes technical research on the troubles of privacy and security and explores solution for its problems using five phase agent models. MAS can interact to solve problems that are beyond the individual capacities or knowledge of problem solver. In the past several years, agent technology has played a central role in many application areas. It also provides a decentralized and adaptative approach for automated data capture and tracking in real-time which is a major constriction affecting the ability of stakeholders to optimize their investments in supply chain solutions. RFID combined with the MAS would be able to address these points and provide a range of benefits across various uprights.

**Keywords** - Agent oriented system; Electronic Product Code; Privacy; Project Chain Management; Radio frequency Identification; Security ; E-Commerce.

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## 1. Introduction:

A crucial element for an effective and efficiently managed chain management includes accurate real time information about the products within the chain. RFID is classified as a wireless Automatic Identification and Data Capture (AIDC) technology that can be applied for the identification and tracking of entities. The integration of RFID systems within a company's supply chain offers a copiousness of economic and productive capabilities. An RFID is a "white color" tag with an implanted microchip containing product information which can be accessed by a receiver using radio frequencies. The "white color" tag is affixed to the product at the pallet level while still at the warehouse prior to shipment.

Business giants such as Waitrose, Ocado, and Marks & Spencer (M&S) etc have accepted the importance of leveraging RFID technology to improve and increase operating efficiencies in the supply chain, which is profiting from recent advances in electronic cataloguing. With RFID systems, companies would have increased product visibility, reduce out-of-stock items, trim warehouse costs, eliminate stock errors, reduce theft and shrinkage and allow companies to regularly update their logistics and inventory databases.

Different pilot studies are currently in progress throughout the world to study RFID system application and its integration within existing Enterprise Resource Planning (ERP) systems. RFID is the latest magic bulletin in the technological scope that has the potential to make a sweeping shift in the way any organizations approach their supply chain. Wang et.al, (2009). RFID is enabling companies to see further into the supply chain than ever before, providing more accurate real-time information and improvements in process efficiency. The increased visibility can result in faster inventory turns, less shrinkage, reduced labor and higher material flow through warehouse or distribution center. Mangina et.al, (2002). Greater efficiency means RFID-enabled processes take less time and effort; entire pallets of product can be recognized in seconds without the need to break them down, and cycle counting inventory can be accomplished in hours or even minutes instead of days. RFID tags are small, wireless devices that help identify objects and people.

Agent technology is an emerging research area which increasingly contributes to the development of value-added information systems for different applications. An agent is a small autonomous or semi-autonomous program that performs a set of goals and then provides its results to the stakeholders in a format readily acceptable by that stakeholder.

An MAS models problems in terms of autonomous interacting component-agents, which is proving to be a more natural way of representing task allocation, team planning, user preferences, open environments, and so on. This work develops a practical method for modeling and distributed simulation of complex situated MAS, which are highly dynamic and possess an intrinsic spatial character. It enhances overall system performance, specifically along the

dimensions of computational efficiency, reliability, extensibility, robustness, maintainability, responsiveness, flexibility, and reuse.

This paper is divided into six sections. The first section is the introduction. The second section focuses on the related work. The third section surveys the PCM overview. The fourth section illustrates the multi-agent approach and its methodology. The fifth section, discusses a complete case study. And the last section concludes the work and discusses the future of the research.

## 2 Related Works:

A survey of (Garfinkel and Rosenberg, 2005) gives a better elementary instructional text and overview on some of the central topics in RFID security. Matta et al., (2009) limit the scope of their examination to product authentication and a discussion of the trade-off between complexity and security in different RFID authentication methods. Moreover, there are publications on state-of-the-art in RFID privacy preservation, as well as numerous reviews on security and privacy concerning health care, e-commerce and data mining. The latter two are especially interesting, as essential privacy questions in these fields, like “What data is collected?” and “How is data secured during transmission?” apply to RFID as well. The central factor underlying these topics in e-commerce is trust, a topic that can easily be anticipated in an RFID context. When RFID tagged objects hit the end-user market at a large scale, consumers’ willingness to provide data will likely depend on individual perceptions of trustworthiness, just as it does in e-commerce. Such perceptions will be directly based on the security and privacy provided. Due to the invasive nature of RFID tags many privacy issues and concerns exist. An issue that moves to the forefront with the use of RFID tags deal with tracing and tracking of RFID tags. Additional methods have been proposed for rendering RFID tags inoperable. Implementation of devices and methods such as blocking tags, clipping tags, soft blocking tags, selective blocking tags, and kill commands are used to block or impede the propagation of the RFID signals. Blocking tags are special devices/tags that interfere with the protocol that is used for communication between normal identification tags and readers (Bottani, 2007) and (Ngai and Gunasekaran, 2007). Tag clipping involves disabling the RFID device by removing or breaking the connection between the chip and the antenna.

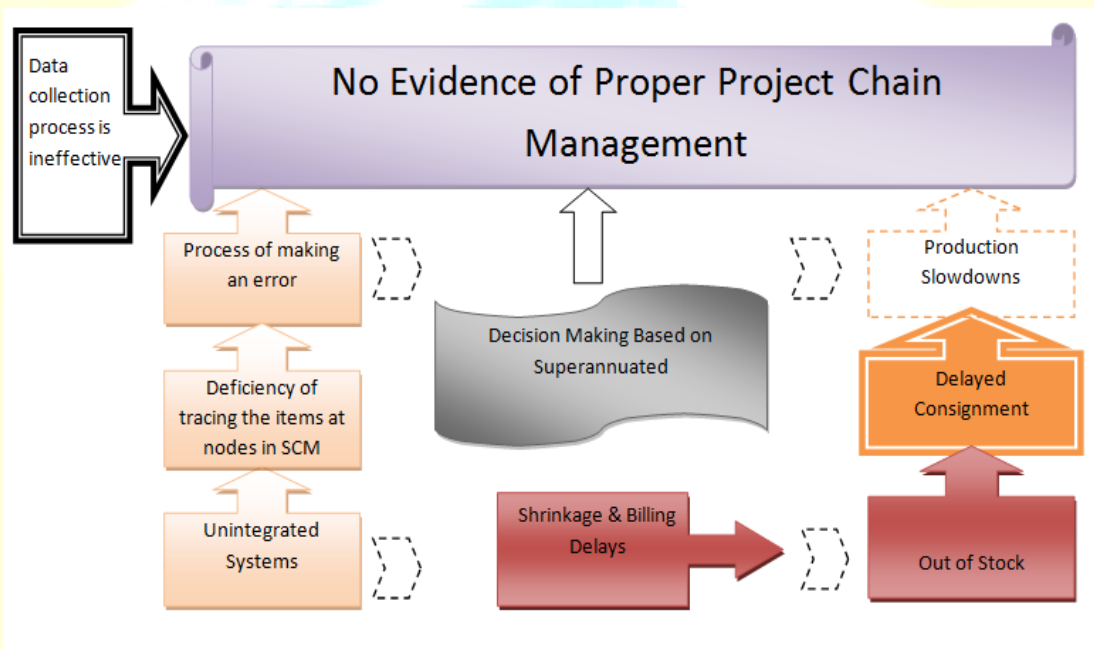
## 3. PROJECT CHAIN MANAGEMENT OVERVIEW

Let’s check whether the chain management supply is working at the expected percentage levels say 100% or 85%? If it’s not! Reasons can be multiple. Let’s focus on the rational motive and their consequences.

With respect to retail environment the problem can be position inside better perspective where there are almost millions of SKU’s (Stock Keeping Units) to be handled. Stock-outs have a high negative impact on the top-line as well as bottom-line, according to a survey carried out by PMI.

The survey had a sample size of 28,000 respondents in around 9 countries. It indicates some of the fears the retailers and companies managing different brands have with regards to consumer buying behavior.

The most significant finding of the survey suggests that retailers could lose nearly half of intended purchases when faced with stock outs. For a company like M&S this could mean 3% of the sales. That's a staggering 7 billion by M&S current size. (Gourdin, 2001). Surplus production seems to be the obvious solution but it may have some awful effects on any firm because of highly decreasing product life cycle where the factor of obsolesce is very high. RFID technology uses tiny computer chips (tags) and radio waves to transmit the identity of an object wirelessly. The RFID tag, which can be attached to or incorporated into an object, contains a passive antenna to enable it to receive and respond to radio-frequency queries. Figure 1 shows the overview of Chain Management Process with unconventional planning.



**Figure 1:** Chain Management Process

A typical RFID reader is a device that has one or more antennas that emit radio waves to energize the RFID tag and receive signals back from it. RFID technologies have been used extensively for tracking freight containers Pan et al, (2009), logistics and supply chain management (Hohberger and Tsirlin, 2009), and components within industrial sites Visich et al, (2009). RFID is a type of auto ID technology that uses radio waves (as the name RFID denotes) to identify, monitor and manage individual objects as they move between physical locations. So, RFID is a smart sensing technology. The RFID Technology has been compared with the existing and well-established competing Bar-coding Technology.

## 4. RESEARCH METHODOLOGY – MULTI-AGENT APPROACH

The methodology is to present the combination of RFID and MAS approach. Three agents will be performing the tasks to analyze the problems of privacy and security for RFID and to provide solutions for the proposed problems using five phase multi-agent life cycle models.

The goal of the first agent is to organize the system in PCM. The second agent will be defining the policies to conduct risk assessment and the third agent will do the verification and validation part to conduct a comprehensive set of tests to verify functionality in response to the inputs.

### *4.1 Seclusion and Security Considerations*

Seclude considerations are interrelated with security considerations. A key objective of any RFID security program is to identify risks and controls for safeguarding personally identifiable information. An organization implementing a security and privacy program for an RFID system should consult its privacy officer and legal counsel throughout the information system development life cycle.

### *Solutions for RFID Problems Using Five Phase Multi-Agent Life Cycle Models*

In order to support the business processes it automates the RFID systems should be highly customized. In spite of that, organizations can be benefited when using RFID technology. It gives a description of a set of recommended security practices that can help organizations manage RFID risks to a satisfactory level. RFID security controls should be incorporated throughout the entire life cycle – from policy development to operations in order to be effective. The five-phase multi agent life cycle helps organization to determine the most appropriate actions to take at each point in the development of the RFID system.

### *4.2 Proposed System Life Cycle Phases*

The phases of the life cycles of MAS are as follows.

#### *4.2.1 Phase 1: Initiation*

The initiation phase covers the tasks that an organization should perform before it starts to design its multi agent RFID system. This includes conducting a risk assessment and developing policy and requirements with which the RFID system must abide by. Figure 2 illustrates the multi-agent process of RFID risk assessment.

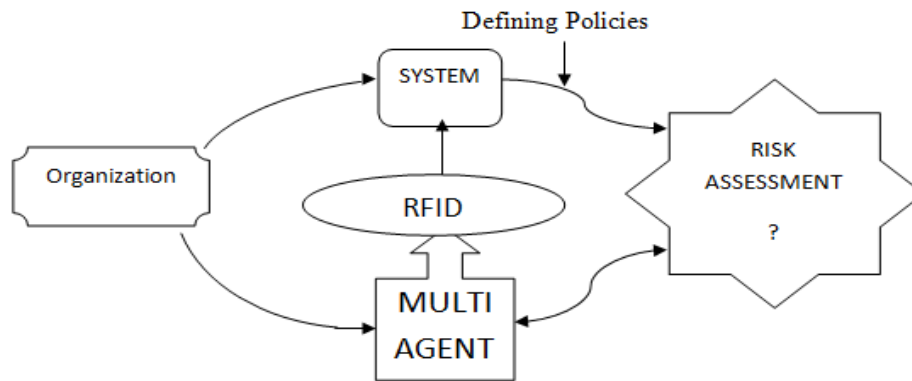


Figure 2: Multi Agent RFID Risk Assessment

#### 4.2.2 Phase 2: Acquisition/Development

This phase is split into two sub-phases: Planning and design and Procurement.

##### Planning and Design

In this sub-phase, RFID network architects specify the standards with which the RFID system must follow with the agent, the network infrastructure that will support the system, and the technical characteristics of the RFID system, including the types of tag and readers that will be deployed.

##### Procurement

In this sub-phase, the organization specifies the RFID components that must be purchased, the feature sets and protocols they must support the agent software, and any standards on which they must be based.

#### 4.2.3 Phase 3: Implementation

In this phase, procured equipment is configured to meet operational and security requirements, RFID data is integrated with legacy enterprise systems.

#### 4.2.4 Phase 4: Operations/Maintenance

This phase includes security-related tasks that an organization should perform on an ongoing basis once the RFID system is operational, including conducting periodic security assessments, applying security-related software patches, and reviewing RFID event logs.

#### 4.2.5 Phase 5: Disposition

This phase encompasses tasks that occur when a system or its components have been retired, perhaps as a result of a significant upgrade. These tasks include preserving information to meet legal requirements and disabling or destroying tags and other components when they are taken out of service.

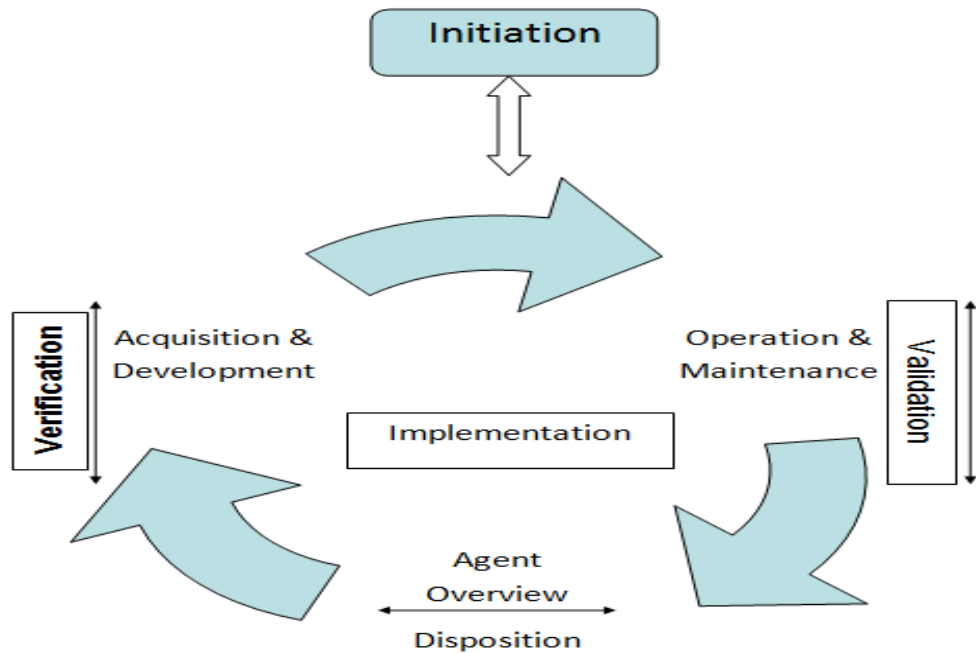
## 5 Case Study: Project Chain Management of Hazardous Materials

Radionuclide Transportation Agency (RTA) oversees the movement of radioactive research materials between production facilities, national laboratories, military installations, and other relevant locations. The RTA oversight of the supply chain for these materials involves many of the same issues as in most any other supply chain. The agency wants to know who is in possession of what quantity of materials at any given time. It also wants to locate materials at a site quickly, without having to search through numerous containers to find them. (Garfinkel and Rosenberg, 2005). Bar code technology does not provide that capability. Some of RTA's requirements are more unique. For instance, much of the transported radionuclide material must be closely monitored because extreme temperatures or excessive vibration can make it useless for its intended applications. Consequently, RTA wants temperature and vibration sensors to continuously measure environmental conditions and record readings on the tag. Additionally, the handling of RTA-regulated materials is a homeland and national security issue. (Matta and Koonce, 2009) If the materials were to fall into unauthorized hands, they could endanger the public welfare.

### 5.1 Initiation Phase

Risk assessment is done by the learning agent, which identified a number of concerns, the most significant of which were as follows:

- 1) An agent could identify and target a vehicle containing RTA-regulated material.
- 2) An adversary can eavesdrop on tag transactions to learn the characteristics of the material, which could help determine whether it is worth stealing.
- 3) It could damage or disable a tag, making it easier to steal material without detection.
- 4) It could alter sensor or manifest data stored on the tag in an effort to undermine the business processes for which the material is being used.



**Figure 3:** Phases of Agent Life Cycle

5) The radiation from readers could accidentally cause combustion of collocated volatile materials when several of them are operating concurrently in close proximity. To help address the risks, RTA established a policy that required that tagged items only be identifiable during embarkation, debarkation, and storage, but not during transport. The policy further stated that “tag-reader communication should be authenticated whenever technically feasible with commercial-off-the-shelf systems.” (Mangina, 2003)

### ***5.2 Acquisition/Development Phase***

The acquisition/development phase focused the learning agent on the planning and design of the RFID system. The nature of the project chain was such that tagged items would be located at numerous facilities, including future facilities not yet known at time the design was created. However, some general parameters were known. For instance, readers would need to read tags from distances up to 10 meters, and this capability is typically only found in active tags. To address the requirement of preventing readings during transport, the team specified agent mechanisms for shielding containers and vehicles. The shielding would prevent adversaries from determining that items inside a vehicle were tagged, thereby reducing the risk of targeting. In the case of shielded transport vehicles, tags could be read when they were removed from the vehicle at debarkation.

Many vehicles were shielded prior to the RFID program to prevent harmful radiation from escaping the vehicle. When vehicles were not shielded, tarp-like shielding could be placed



around containers within the vehicle and then easily removed when they leave the vehicle. While some users would benefit from the convenience of reading tags from outside the vehicle, the risk this introduced outweighed any potential advantage it offered. The tags were also password-protected using a proprietary technology to prevent unauthorized parties from reading or writing to the tags (Wooldridge and Kinny, 2000). Because custody of the tags moved from one organization to another, the RTA decided to host a central password database that could be remotely accessed by the RFID middleware of each participating organization.

### *5.3 Implementation Phase*

This phase was pointed directly ahead given the panoptic planning in the previous phase. The initial task was to conduct a pilot test of the system to identify potential problems before they adversely impacted the full supply chain. The test exercise uncovered several interoperability issues with RTAnet devices. In particular, some of the readers did not work properly with the middleware because an undocumented feature conflicted with the settings RTA selected for its equipment.

### *5.4 Operations/Maintenance Phase*

The RTA was able to obtain regulatory information rapidly as soon as the system was fully operational, this reduced the labor time required to support the program.

### *5.5 Disposition Phase*

RTA has not actively faced up disposition issues. It plans to impart skills to participating organizations to retire their RFID systems as they would any other system holding data that RTA deems sensitive. In most cases this involves using disk wiping utilities to delete sensitive files. With regard to tag disposition, RTA's position is that organizations are free to recycle tags so long as they clear sensor and manifest data before affixing a tag to a new item.

## **6 CONCLUSION**

Agent approach to a system provides better response times as well as quicker notification processing. MAS do have an increasingly important role to play in Project Management because they significantly enhance our ability to model, design and build complex distributed management software systems. As the RFID technology is becoming cheaper, it is sure that it will be implemented in everyday life soon. We proposed a Multi-Agent RFID process in PCM with the help of system life cycle phases. Each phase has its own agent which will work independently on its merit and provide a solution. This solution can help project managers to take immediate decisions, when responding to an emergency situation. The research team proposed the use of MAS to provide a complementary result to hardware system in order to integrate it in different management systems. Furthermore, RFID operating standards do not exist for global operation, which would make tracing and tracking difficult for both import and

export goods. As future work we plan to continue the research which needs to be carried with the help of MAS before RFID can realize its full implementation.

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