Creating an Intelligent Infrastructure for ERP Systems: The Role of RFID Technology

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At its core, ERP is essentially a large database. As increasing amounts of data become available through new technologies such as RFID, the nature of ERP and the infrastructure needed to support the system will change dramatically. This article explores just a few of the issues that will surround this change.

Simply stated, an enterprise resource planning (ERP) system identifies and plans "the…resources needed to take, make, ship and account for customer orders." [1] To achieve these important tasks, ERP uses a variety of information technologies such as graphical user interfaces, relational databases, advanced computer languages and computer assisted software engineering tools. In essence, implementers of ERP systems seek to plan and control all the resources in a manufacturing or service-oriented company.

The development of ERP systems traces to the early foundations of material requirements planning (MRP) and the advent of the widespread use of computers that have defined the information revolution of the past 60 years. Initially, one of the most important aspects of MRP involved the entry of data such as inventory for each

component, location within the manufacturing operation, bill of material and cost data, and customer due dates. In many respects MRP, the subsequent development of manufacturing resource planning (MRPII), and ERP, represents increasingly sophisticated databases that over time have improved tactical and strategic business planning. The result of this dramatic increase in the amount of data and information available to planners has been much improved inventory management and better utilization of important assets such as manufacturing capacity. It is hard to imagine how a modern business could be successful without the data management capabilities of an ERP system.

Essentially, an ERP system serves an "uncertainty absorption" function.[6] It is impossible to know with certainty all future outcomes that might occur for a business. There are very few if any situations where certainty of outcome can be claimed by management. However, with enough data and the proper methods of analysis, reasonable projections of future outcomes become feasible. Having data allows for the possibility of calculating risk, where several different outcomes are possible, and a calculated probability from the data can be assigned to each outcome. The crowning achievement of ERP systems in practice is that business decision making has moved from an *uncertainty basis* where no comprehension of risk existed, to a *risk basis* where ERP serves the important function of mitigating uncertainty. The result; much more effective business decision-making based on rational analysis of data rather than pure conjecture

With the established success of ERP packages in practice it is realistic to begin thinking about what changes in information technology will happen that will further enhance ERP, thus reducing even more uncertainty within business planning. Since ERP is at its essence a data management tool, it is reasonable that any advancement in the way that

data is obtained, organized, and employed will have a significant impact on the structure of ERP software.

For example, advances in algorithm development open the possibility of doing "capacitated MRP"[7] on a routine basis for all levels of a manufacturing process. While the algorithms to do aspects of capacitated MRP are available, the drawback to implementation is partially dependent on lack of real-time data needed for a meaningful solution.

The problem of data has plagued planners for many years. Even with advances in the sophistication of databases the problem of handling data, and the application of the correct analytical tool to the data available, has remained an area of great potential for improvement. Advances in data capture, such as bar codes, have expanded the reach of ERP to greater quantities of the data needed for business planning. However, most ERP systems depend on batch operations to process the data collected from various devices such as bar code readers. In many situations, updates occur only on a daily basis, falling well short of the goal of a continuous stream of data feeding ERP systems. Further, much of the identification data is not granular to the level of providing unique identification for individual objects within a manufacturing or service operation, or the supply chain at large.

A recent online survey conducted by APICS supports this observation. When polled about the relevance and main goal of radio frequency identification (RFID), 55% of respondents indicated improved inventory accuracy was the most important objective. Notoriously prone to errors, the ability to track and trace items through a manufacturing operation or an entire supply chain with the goal of 100% inventory accuracy remains elusive. This type of effort represents a huge challenge to current information technology infrastructures that are designed primarily for batch updates to ERP systems. In addition,

increasing efforts to introduce automated methods of planning and control within manufacturing and service operations, and entire supply chains, depend on accurate, real time information and unique identification of individual objects.

To fill this gap, computer science researchers have conceptualized a new type of information technology infrastructure that meets the challenge of real time information and unique identification. This type of infrastructure aims to link physical objects to a network, like the Internet, with RFID technology. There is no question that this new infrastructure will radically change the nature of ERP systems with the result being an order of magnitude increase in productivity. Traditional forms of delivering information technology, such as dedicated software packages that require strict adherence to predetermine ways of planning, will yield to repositories of "software agents" such as planning and scheduling models that will be combined as required to meet the needs of existing organizational processes. This will result in a truly intelligent infrastructure that will allow great flexibility in collecting data through RFID technology and the matching of relevant models to the data at hand.

Such a system is only possible through development of open standards and protocols for collection, sharing and matching data to models. Without a system based on open standards, interoperability will not be possible and the economics of building suitable interfaces will overwhelm the economic value of the new infrastructure.

Beyond the new information technology for handling data, the infrastructure built on RFID lays the groundwork for the intelligent value chain of the future. Creating "smart products" that sense and respond with the physical world requires unique identification. With this capability, distributed control systems can interact and give instructions to a

specific object. For example, some time in the future smart objects within the consumer goods supply chain might dynamically change price based on sensing demand at retail stores.

To develop the ideas of creating an intelligent infrastructure, APICS has organized a community of practice that deals specifically with RFID technology and the implications for the ERP. We encourage you to participate in this discussion list, and to take an active role in the development of the new intelligent information technology infrastructure needed to guide the ERP systems of the future.

APPENDIX A

RFID Poll

What is your main goal in implementing an RFID solution?

Improve inventory accuracy	55%
Trading partner requirement	13%
Increase inventory turns	10%
Reduce out-of-stock situation	9%
Enhance supplier relationship	9%
Improve fill rates	4%
Sample size	658 respondents

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