

CLARIFYING THE COST REQUIREMENTS OF RFID AND THE UNIT OF ANALYSIS PROBLEM

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ABSTRACT

Radio Frequency Identification (RFID) is a set of technologies that will impact many aspects of our World. One important focus for the application of these technologies has been supply chains in business. It is commonly assumed that RFID will simply replace bar codes in business. The efforts at applying RFID do indicate that this might not be the case. Celebrated instances of the use of RFID point to difficulties when the containers are metal or filled with liquid. However, there is a separate locus for the impetus for custom RFID applications in the nature of supply chains that should be considered.

An interesting characteristic of supply chains is that there is usually not one single “steward” for the entire supply chain. That is, while the goods are moving from their source (production facility) to their destination (retail facility) they will be in the “custody” of several companies. Thus while the goods may on occasion be owned by one company for the entire supply chain, they are seldom in the custody or stewardship of one organization for the entire supply chain. This in and of itself is not a problem, and in fact brings great advantages to everyone. However, the interest of a particular steward at a particular point in the supply chain is rarely in the “retail unit”. For example, a shipping company is not likely to be interested in how many bottles of shampoo are on any given truck, but they are likely to be very interested in how many boxes of shampoo (and their gross weight) are on a given truck. As a result, new bar codes tags are prepared and attached by each steward in the process to track the unit of analysis relevant to their part of the process. The result is that there is a natural tendency toward independence in supply chains using bar codes. This tends not to be a problem as long as the tracking technology is sufficiently inexpensive, and as long as only rudimentary information is shared among the steps. The resulting problem is that the financial expectation on new technologies (RFID) is fundamentally flawed. A label for this problem is the unit of analysis problem.

The purpose of this paper is to provide an initial indication of how out of line the cost expectations for RFID tags might be. For example, if bar codes tags are a penny each and that is the expectation for RFID tags, and the average number of bar code tags used per retail unit is three for the entire supply chain then the expected cost for RFID tags is tree times greater than it should be. To examine this we will provide an abstracted supply chain, note the changes in unit of analysis for the supply chain and provide a total supply chain cost for identification. This will be compared to the published expectations for the cost of RFID tags.

The intended result of this exploration is a better understanding of how RFID will become incorporated into supply chains. It is hoped that clarifying these expectations will help to avoid the loss of potential benefits from RFID due to unrealistic cost expectations. This is likely to be of general interest for the operational side of business.

INTRODUCTION

This paper is about movement of information. While the focus of the paper is on technology, supply chains, and changing technology – the purpose of all this effort is the value produced by “better” information. This purpose should be a generic management vision for the supply chain world well beyond the focus of individual actors in the process.

Making the value of information a concrete concept is very important to this effort. Many years ago we were giving a lecture on the history of telecommunication. One of our favorite examples of how valuable information is came from our discussion of the history of the telegraph. One of the first telegraph operations was a point to point link from Boston to New York. This occurred in the mid 19th Century. It seemed obvious to us how such a link would be used. We put the question to our classes, and generally received blank expressions in return. The point is so important we stayed with the effort. We finally got the class to realize that Boston is a port city, and New York is where the markets reside. With some effort we finally got the students to realize that a telegraph could reduce the time for the movement of information about what goods arrive in Boston at what time from Days to Seconds! The value of that information is so great that it more than pays for a link from Boston to New York! In effect the information for the supply chain has a similar or even greater value and the means of producing that information are critically important.

RFID

Radio Frequency Identification (RFID) is a technology or more properly technologies that will impact business operation the world over in time. As one might expect some business efforts contain such large costs that some enterprises and even whole industries will invest in what should be viewed as “custom” systems to support the efforts. Some of these efforts are quite famous and provide illustrative examples. However it is important to remember what they are not. They are not the “norm” for the future and they are not intended to be such a norm. However, the examples are quite interesting.

One of our favorite examples of what we would refer to as “custom” RFID is Del Monte. This is a rather well know example of an RFID implementation. Del Monte is a company that provides canned fruits and vegetables to supermarkets. Remember that the RF part of RFID stands for Radio Frequency, and also note that canned implies metal and liquid. Both metal and liquid interfere with radio signals. Thus Del Monte’s effort is specific to Del Monte, however, the nature of its business is such that investing and maintaining this effort provides a clear benefit to the organization. Additionally, a “standard” RFID may not provide support to this kind of operation. This is illustrated by recent efforts to provide RFID on metal products [1]. In order to compensate for the radio interference caused by metal fat tags have been developed. These tags have a thick pad that provides space between the RFID tag and the metal object on which it is affixed. While this is a promising solution it still makes RFID tags more expensive than bar code tags – which is the currently assumed goal for “standard” RFID tags.

Moving toward “norms” is becoming reality in some industries. One “industry” that has been in the automated identification domain since the beginnings is the Library. Just as with bar codes Libraries have been involved and investing in RFID. The reasons for this are inherent in the nature of a Library, but the more interesting phenomena is the movement toward a “standard” approach or “norm.” Libraries like institutions in any industry have great variations. Large libraries at major universities or large government libraries have such a scale that the benefit of having a proprietary system for a few years prior to the establishment of a “norm” provides their organizations with great benefits. At the other end of the spectrum a small library at a small law firm may not see much benefit from any effort in this area. The interesting problem that this provides – which will happen in many other industries – is the need for migration from proprietary products to the “norm”. In effect, for a large library it would be nice to switch to a new system and leave the old tags in place. It appears that this will be possible [2]. 3M has established a product that will help this effort. Given this example, what can be observed about the supply chain that can give us hints about the “standard” RFID that eventually evolves?

CHAIN OF CUSTODY

It might have passed beneath the attention of the average person but the process between collecting the material needed to produce a product and delivering that product to the sales floor has changed radically over the past few decades. There are very few examples of this process that are still similar to building a cake from scratch at home, in fact almost everyone has partners in the process. There are probably few examples of even building a cake from scratch at home.

The topics that are discussed related to this arena are Globalization, Outsourcing, and Offshoring. Most of these topics involve a bit of hyperbole and some emotion that clouds the view. For example, while there might be abuses it is important to realize that partnering is the natural result of doing the right things in business. It is important to understand that this is the natural result of working on what you do well – your front room – and getting other businesses to provide those things that support this function which they do well [3].

So the result for this process is interesting. In effect, those large operations that had such difficulties with Material Requirements Planning (MRP) in the 1970s when everything was under one roof are now global supply chains with pieces of the process spread among several companies, in several countries, and likely on several continents. Did the need for the information in the MRP systems change? The answer is no, but the means of dealing with the information has changed. The new global supply chains have “features” at the hand off points that were not involved in MRP systems under one roof. These include contracts, and customs. However, the effect of the change in focus this involves is more difficulty for the development of strategic information – that is this tactical information is difficult to aggregate into (ironically) global information about the process.

This is from the process itself and the issue is that the “unit of analysis” changes as the goods are moved in the supply chain. As stated in the abstract - a shipping company is not likely to be interested in how many bottles of shampoo are on any given truck, but they are likely to be very interested in how many boxes of shampoo (and their gross weight) are on a given truck. As a result, new bar codes tags are prepared and attached by each steward in the process to track the unit of analysis relevant to their part of the process – thus fulfilling their contractual requirements. This is the expectation for RFID that is used to produce the low cost per tag that is mentioned as a requirement for this technology. The problem with this approach is that dozens of bar codes are discarded in our current approach and while that might seem reasonable for paper and ink – is it really reasonable for an RFID tag?

IMPLICATIONS OF RFID COST EXPECTATIONS ON RFID SYSTEM DESIGN EXPECTATIONS

This approach to thinking about RFID is very familiar to IT veterans. In fact for 30 or more years there has been a label for this thinking – it is “paving cow paths”. The term refers to applying IT to a business process without making the effort to analyze the effectiveness (not just the efficiency) of the business process. The first time we recall seeing this reference was in a 1980s Wall Street Journal article of the effort by the New Jersey Department of Motor Vehicles to implement an enterprise wide system using a 4GL (fourth generation language). The system was not performing well at that time and the reason seemed to be “paving the cow path”.

This RFID issue is similar, however, there is a difference that is quite important. What this paper has been examining is the development of a “norm” or a “standard”. There have been in IT’s short history relatively few examples where a “standard” is “paving a cow path”. Usually one of two forces mitigates against this – either the “laboratory” development process or the market. One might hope that these forces will work again in this instance, however, this situation is quite unique. The “laboratory” essentially has several technologies for this effort and is working to “integrate” rather than “invent” a solution. The

market does not have an “end-user” that represents the entire process and the point of partnering is in fact to move away from the effort that the “global” view requires.

Thus, when one considers that value of information proposition made in the Introduction the RFID Cost Expectations are out of line with the potential value of the improved process. Further, the idea of imitating the use of bar codes with RFID tags defeats that potential value of improved information and creates wasteful (thus expensive) processes.

A MORE APPROPRIATE DESIGN EXPECTATION

A more appropriate approach should involve making RFID tags that move through the supply chain. Given the capabilities discussed about RFID these tags could handle the unit of analysis problem. That is as 24 products are packed in a box one of the RFID chips becomes the reporter for the box, and as several boxes are placed in a crate one of the reporters for the boxes becomes the reporter for the crate. Thus the tags are useful throughout the supply chain.

Finally, if an RFID tag moves through the process the “cost” for the RFID tag should be targeted at how many bar codes it replaces. However, we would argue that this cost should also include an allowance for the value of the improved information.

CONCLUSION

Finally, remember the point to point Boston to New York telegraph system in the mid 19th century. With over 150 years of experience with the value of information some aspects of the process of moving to better information become apparent. These include recognizing that there is better information, and making the investment to get that information. Perhaps the only force that will help in making the “standard” RFID is the only force it will need. That is a visionary that invests in the possibilities.

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