Chapter 105
Justifying RFID Investment to Enable Mobile Service Applications in Manufacturing and Supply Chain

In Lee
Western Illinois University, USA

ABSTRACT

Radio Frequency Identification (RFID) technology is rapidly expanding its application area from simple inventory management to advanced location tracking and supply chain management in a wide range of industries. Because of the potential benefits gained and high investment costs incurred by RFID, firms need to carefully assess every RFID opportunity and challenge to ensure that their resources are spent judiciously. Because of the lack of analytical methods for measuring the benefits and costs, this chapter presents a mathematical model for the evaluation of RFID investment in manufacturing and supply chain. This model provides a basis for the authors' understanding of RFID value creation and ways to build an RFID business case for an RFID investment justification.

INTRODUCTION

Radio Frequency Identification (RFID) technology is one of the emerging technologies that is being used by a number of organizations such as manufacturers, retailers, logistics providers, hospitals, and libraries. Radio Frequency Identification (RFID) technology is changing the way business processes are designed and business operations are performed (Lefebvre et al., 2005). RFID technology shows great potential for cost reduction, supply chain improvement, and partner relationship management in various industries. A recent case study on a system of integrating mobile commerce and RFID applications illustrates that the RFID provides greater visibility of the operations data and improves the control processes (Ngai et al, 2007). Furthermore, RFID

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is considered as a strategic information technology which introduces new value propositions and creates new markets (Christensen et al, 2004; Krotov & Junglas, 2008). Therefore, the timing and magnitude of the RFID adoption and related process redesign have become more critical than before as the technology advances at an unprecedented speed.

RFID technology management is the process of evaluating RFID technology, developing RFID systems, and managing RFID infrastructure to achieve business objectives. In the evaluation stage of RFID technology, managers identify potential business processes, explore different RFID technology options, assess their cost-benefit, and choose the best technology. Despite the popularity of RFID technology, the disappointingly slow return on RFID investment forced senior managers to scrutinize the investment opportunities more closely and to reshape their existing RFID initiatives.

As RFID projects often compete with other IT projects for scarce resources, the fundamental questions for the RFID adoption are whether RFID technology can create a value that will justify its investment, and how the value of RFID can be measured. Wal-Mart has implemented RFID technologies in 1,400 of its 4,100 domestic stores and is examining the technology's value and its effect on business processes. It would be very challenging for Wal-Mart to decide which stores to invest in and how much to invest.

However, despite the urgent need for a solid evaluation method in the industries, RFID valuation methods have not been fully developed, and measuring RFID value has been elusive for managers. Traditionally, accounting and financial methods have been widely used to assess the value of projects. Return on investment, net present value, and payback period methods are classic in accounting and financial literature. However, the traditional accounting and financial methods have played a limited role in justifying the RFID investment opportunities, because many of its benefits are non-quantifiable.

In light of the ongoing debate on the valuation of RFID investment, this chapter provides an overview of existing evaluation studies, presents the RFID investment evaluation model, and discuss a future direction for researchers and practitioners. The major contribution of this research is that to present three supply chain RFID investment factors and developed analytical procedures to derive optimal RFID investment levels for these factors. Our paper proceeds with literature review in Section 2, the evaluation model in Section 3, RFID investment procedures and parameter estimation techniques in Section 4, an analysis of the investment model with an illustrative scenario in Section 5, and the conclusion in Section 6.

LITERATURE REVIEW

The global industry for RFID technology has been growing steadily and is expected to grow rapidly before stabilizing and settling on a steady growth path. These statistics suggest that RFID has become one of the most important IT investment opportunities for firms, and thus RFID investment deserves special attention from management.

Business Value of RFID

Like other IT value measures, RFID business value includes lead time reduction, productivity improvement, cost reduction, increased revenue, customer satisfaction, competitive advantage, inventory reduction, and other metrics of performance (Michael & McCathie, 2005; Angeles, 2007; Veeramani et al., 2008). Dutta et al. (2007) examined three dimensions of the value proposition of RFID as an initial roadmap to view ongoing research: the generic architecture of RFID implementations and the drivers of value, measurement issues, and incentives for achieving that diffusion.

Despite the growing diffusion of RFID, many organizations take a "wait and see" stance and hope to learn more from the early adopters, since