A Study on Green Characteristics of RFID using Innovation Diffusion Theory

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INTRODUCTION

Radio frequency identification (RFID) is one type of auto-identification technology that uses radio frequency (RF) waves to identify, track and locate individual physical items. This technology has been used in many applications including manufacturing and distribution of products (Lin & Ho, 2009a,b). While RFID is useful in improving several functions within a firm, we focus on the logistics function in this study. Applying RFID can help improve logistics in several ways. Lin (2009) points out that the capabilities of RFID to closely monitor and track positions of vehicles can assist companies to successfully manage their warehouses and supply chains. Additionally, cost savings, supply chain visibility, and new process creation have been identified as three key benefits of RFID adoption (Roh et al., 2009). Wamba (2012) claims that RFID can be useful in integrating supply chains by improving shipping and receiving processes, automatically trigger specific processes, foster higher level of information sharing among supply chain partners and finally promote the use of new business processes.

In spite of significant number of research studies on RFID, there is a limited amount of published knowledge on the discussion of the drivers or influencing factors that lead logistics industry to consider RFID. Given the increasing importance of green issues, there is a need to understand how the perceived positive green characteristics are affecting the level of adoption of the RFID technology. The aim of this paper is therefore to explore the factors affecting logistics service providers' intention to use RFID, with special emphasis on its environmental friendly green characteristics. The theory of diffusion of innovations (Rogers, 2010) is used to develop a conceptual model of factors influencing RFID adoption.

LITERATURE REVIEW

Background of RFID Technology and the Literature

An RFID system consists of three primary components: the tag or transponder; the readers; and the middleware. It is always connected to an enterprise application system for data processing in support of

business activities (Wang, et al., 2010). RFID uses tags with embedded chips within a product, pallet, or case. These chips help to store and transmit information about the specific unit to RFID readers (which are radio frequency transmitters) (Attaran, 2007). According to Wang, et al. (2010), the middleware is an intermediate layer between the RFID readers and the enterprise application systems. It is used for reader and device management to provide a common interface to configure, monitor, deploy, and issue commands directly to readers; data management to filter raw data and pass on only useful information to the appropriate applications; application integration to provide integrated RFID data and connect disparate applications within the enterprise; and partner integration to provide collaborative solutions like business-to-business integration between trading partners.

In recent years, there has been a growing interest and attention among consultants, academics and researchers worldwide on RFID. This is indicated by the increasing volume of articles on the subject in trade publications and scholarly journals. A steadily increasing number of logistics companies adopt RFID for efficient identification of physical items, and hence several recent studies suggested that the interest of researchers in RFID should continue (Riedel, et al., 2008; Li, et al., 2010; Pedroso, et al., 2009). Li et al. (2010) classified the literature of RFID into three areas: RFID general overview, analytical studies, and empirical studies. In this chapter, a theoretical perspective to the adoption of RFID using the theory of diffusion of innovations is provided. This theory is briefly described and hypotheses based on tenets of this theory have been developed in the next section.

INNOVATION DIFFUSION THEORY AND THE RESEARCH HYPOTHESES

The theory of innovation diffusion (Rogers, 2010) is one of the most widely applied theories in the prediction of organizational level technology adoption (Wang et al., 2010). It provides the basic model of how perceived innovation characteristics affect the rate of adoption of innovation (Zhang et al., 2010).

Five Characteristics of Innovation

Rogers (2010) proposed five attributes that are key influencers on the acceptance of an innovation. These characteristics are relative advantage, compatibility, complexity, trialability and observability.

- **Relative Advantage:** The extent to which people believe that the innovation is better than the traditional one. Robinson (2009) highlighted that the greater the perceived relative advantage of an innovation, the more rapid its rate of adoption is likely to be. In this study, intention to use RFID is used as the dependent variable and the following hypothesis is proposed to link relative advantage of using RFID with the intention to use:
  H1: Relative advantage will have a positive effect on intention to use RFID.
- **Complexity:** The extent to which an innovation is perceived as relatively difficult to understand and use (Wang, et al., 2010). Potential users may not have confidence in the RFID technology if it is complex to understand (Wang, et al., 2010). The following hypothesis is proposed:
  H2: Complexity will have a negative effect on intention to use RFID.
- **Compatibility:** The degree to which an innovation is perceived as consistent with the existing values, past values, and needs of potential adopters (Luo, et al., 2007). High compatibility has been identified as a facilitator for innovation adoption (Wang, et al., 2010). The following hypothesis is proposed:

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