European Journal of Operational Research 000 (2015) 1–12

Contents lists available at ScienceDirect

European Journal of Operational Research

journal homepage: www.elsevier.com/locate/ejor

Innovative Applications of O.R.

Integration of RFID and business analytics for trade show exhibitors

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ARTICLE INFO

Article history:
Received 12 April 2014
Accepted 27 January 2015
Available online xxx

Key words:
RFID
Analytics
Trade show
Exhibition
Traceability

ABSTRACT

Drastic changes in consumer markets over the last decades have increased the pressure and challenges for the trade exhibition industry. Exhibiting organizations demand higher levels of justification for involvement and expect returns on trade show investments. This study proposes an RFID-enabled track and traceability framework to improve information visibility at the trade site. The identification information can potentially create detailed, accurate, and complete visibility of attendees' movements and purchasing behaviors and consequently lead to considerable analytical benefits. Leveraging the wealth of information made available by RFID is challenging; thus, the objective of this study is to outline how to incorporate RFID data into existing enterprise data to deliver analytical solutions to the trade show and exhibition industry. The results show that the exhibitor can use RFID to gather visitor intelligence and the key findings of this study provide valuable feedback to business analysts to promote follow-up marketing strategies.

1. Introduction

Participation in trade shows, also known as trade fairs and trade exhibitions, has been an instrumental marketing strategy not only to promote sales of a variety of products and services, but also to share updated information and knowledge, to establish relationships, and to negotiate contracts and deals (Rogers, 2008). Trade shows and exhibitions are regarded as effective and efficient marketing venues for enhancing communications and face-to-face interactions with both current and potential customers. Thus, many industries treat trade show and exhibition participation as a potential element in creating a competitive edge by bringing customers closer to their businesses in a short period of time (Blythe, 2002; Bonoma, 1983).

Drastic changes in consumer markets over the last decades have increased the pressures and challenges for the trade exhibition industry. According to the Attendee Acquisition Challenges & Practice Survey in 2013, event organizers at exhibitions have experienced decreased attendance even though the number of exhibiting companies has remained consistent. The physical size of the exhibition or booth space in net square feet has declined as well (Jenner & Kent, 2013). Many exhibitors at the trade site strive very hard to attract and retain attendees by investing heavily in their marketing and promotion strategies for the exhibitions. Mobile applications and social media (Facebook and Twitter), for instance, are utilized as attendance acquisition and retention tactics. In addition to booth space costs, marketing budgets are allocated to direct mail, email, social media marketing, etc., at an estimated average cost of $27–$140 per attendee and $56–$200 per new attendee (Jenner & Kent, 2013). Because of the high levels of investment for participating in trade shows, exhibiting organizations demand higher levels of justification for their involvement and expect significant returns on their trade show investment. Thus, the challenge is not only for trade shows to yield positive results but also for management to truly recognize the value of participating in trade shows and exhibitions.

Information technology (IT) plays a vital role in all kinds of businesses, especially in facilitating routine business tasks at trade shows and exhibitions. The old-fashioned ways of either manually updating attendee data into a system or accessing information though printed reports is costly, incomplete, prone to error, and eventually, fading away. Many automatic identification technologies (AITs) have been developed to automate such traditional processes. Radio frequency identification (RFID) technology is one way to automatically capture such data. It is built around the idea that information can be gathered quickly and easily by just putting radio transceiver tags on physical objects and then using the tags to know where those objects are (Brazeal, 2009). Literally, RFID is an information and sensor technology that collects data though reader devices and tags that are attached to or embedded inside objects such as a documents, persons, animals, or containers. It basically uses radio waves to transfer data from an RFID tag to a reader (Brown, 2007).

Barcodes, RFID, and sensor networks have been developed and implemented to better manage trade show participation at the exhibiting site. The idea of adding RFID tags to conference and exhibition badges is not new. For instance, a real-time mobile tagging system has been introduced that connects buyers and sellers at fashion trade shows. The attendees can use their mobile phone to

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http://dx.doi.org/10.1016/j.ejor.2015.01.054
0377-2217/

capture trade information such as brands, tagged locations on a map of the conference center, or events scheduled at the trade site through two-dimensional barcodes in the QR code format. Additionally, attendees can save notes or record voice notes along with the brand and business information on their mobile phones so that such information can be retrieved throughout the trade visits (Bisker, Ouilhet, Pomeroy, Chang, & Casalegno, 2008). Bravo, Hervás, Sánchez, Chavira, and Nava (2006) describe a context-aware, visualization-based service and applications using RFID technology at a conference site. The main purpose is to anticipate the attendees' needs during the conference based on their location, schedule, and time in the reception area, the common area, and the session rooms (Bravo et al., 2006).

The majority of the literature on RFID implications in the trade exhibition context is location oriented, focusing on either tracking attendee visits to desired exhibitor booths or enhancing the visitor experience. Relatively few studies outline how to utilize the enormous data generated from RFID technologies to help exhibitors understand attendees' interests and purchasing behaviors. In fact, many business or marketing analysts do not fully understand how real-time updated data from RFID can also be a valuable component of business analytics processes related to trade exhibitions. Thus, in exploring the potential of RFID in the trade show business, the following research question arises: "How can integration of business analytics and RFID improve exhibitors' understanding of customers' purchasing behavior in the trade show business?" To answer this research question, this study proposes an RFID-enabled track and traceability framework that improves information visibility by tracking and recording attendees' movements and activities while they are visiting the exhibition. Leveraging the wealth of information made available by RFID is challenging; thus, the objective of this study is to outline how to incorporate RFID data into existing enterprise data to deliver analytical solutions to trade show and exhibition industry participants.

The rest of this study is organized as follows. After a brief literature review in Section 2, Section 3 presents the traceability-based analytical model that utilizes improved information visibility from RFID technology. The trade show and exhibition environment, along with the current analytical process from an exhibiting company in Thailand, is described in Section 4. The RFID-enabled track and traceability framework that is applicable in the context of trade shows and exhibitions is also outlined. After results and discussion on combining business analytics with RFID data in Section 5, Section 6 contains the conclusions and directions for future research.

Although this study originated within the context of a specific exhibitor at a trade show, the situation depicted at the site is quite typical of what is observed in most trade show and exhibition environments. The case presented in this study can provide fruitful avenues for exploring how RFID can be integrated into business analytics processes, contributing to both knowledge and practice.

2. Brief literature review

RFID has received considerable attention for decades, as it offers tantalizing benefits for improving business performance in supply chain management, inventory control, warehouse distribution, manufacturing, retail management, and healthcare (Gunther, Kletti, & Kubach, 2008; Hunt, 2007; Jones, 2008). Even though RFID has been around for a while, it has only recently been brought to the attention of the trade show and exhibition communities. Bellotti, Berta, De Gloria, and Margarone (2006) have developed location-aware multimedia guides based on handheld devices with RFID tags to help blind visitors in exhibitions. The purpose of the device is to provide general information about the exhibition and the services and to describe selected interest points associated with the RFID tag when the visitors enter specific areas (Bellotti et al., 2006). Many studies report the implementation of real-time location systems to enhance visitors' experiences at museums, conferences, and exhibition sites. RFID is integrated with existing handheld devices such as cell phones or PDAs, not only to improve the communication and interaction between visitors and exhibitors, but also to capture information about exhibits recently visited for further product and service inquiries. The results indicate that the number of visitors and the profits increase and the costs of operations are reduced (Hsi & Fait, 2005; Huang, Wang, & Sandnes, 2011; Lin, Chiu, Feng, & Lin, 2007; Mody, Akram, Rony, Aman, & Kamoua, 2009).

The main purpose of this study is to utilize RFID data to improve analytical processes at the trade exhibition so that marketing analysts can not only detect and predict any changes in attendees' purchasing behavior, but also react to what they actually need with a high quality of products and services. In fact, advanced analytics through data mining approaches have been applied to identify customer behavior patterns in retail, direct marketing, and customer relationship management for decades (Davenport, 2006; Gopal, Marsden, & Vanthienen, 2011; Harding, Kusiak, & Shahbaz, 2006). The key concept of data mining is to incorporate both statistical and analytical techniques to effectively and efficiently identify intrinsic patterns from large amount of data and interpret them into useful information within a particular context (Jackson, 2002; Turban, Sharda, & Delen, 2011). Bose and Chen (2009) provide an intensive review of machine learning techniques, such as logistic regression, decision trees, neural networks, and genetic algorithms, commonly used for selection of targets for direct marketing. They also provide a summary of data used in direct marketing models, from demographic, lifestyle, sociographic data to transaction records, feedback, and customer preferences (Bose & Chen, 2009). Particularly in retail marketing, data mining is used significantly to understand the customer segments based on the records of shopping transactions through the use of credit cards and point-of-sale systems. Retailers can utilize data mining techniques to predict which products customers tend to purchase together, forecast the likelihood customers will purchase products in the store, develop profiles of customers who purchase particular items, examine patterns in stores, or determine the ideal layout for a specific store (Rygielski, Wang, & Yen, 2002). Cluster analysis is also applied to aid in classifying customers into sub-groups that share similar characteristics or interests at different periods of time. RFM (recency–frequency–monetary value), k-means clustering, and Self Organizing Maps (SOMs) are among the popular techniques used for customer clustering and pattern recognition (Bose & Chen, 2009; Collica, 2011). In addition to developing long-term relationships with customers, another important aspect of dynamic retail marketing is to understand changes in customer behavior so that effective promotion campaigns can be established. RFM, association rule mining, and cluster analysis can be used to analyze the patterns of customer behavior based on customer profile and purchased products (Chen, Chiu, & Chang, 2005). Liao, Chu, and Hsiao (2012) summarize research in other advanced data mining techniques and applications in the areas of knowledge-based systems published from 2000 to 2011, which can be applied to this business context (Delen, 2010; Delen, Oztekin, & Kong, 2010; Delen, Walker, & Kadam, 2005; Jackson, 2002; Liao et al., 2012; Turban et al., 2011).

On the other hand, few studies have addressed the integration of RFID data with other data sources in the business and operations to produce analytic value. Al-Kassab, Thiesse, and Buckel (2013) present a case report on RFID-enabled business process intelligence in retail stores. The study outlines the procedure for handling massive RFID data sets and explores the opportunities for generating business value from store management to customer behavior on the sales floor. In the fitting room area, the collected RFID data is used to analyze not only the number of try-ons in fitting rooms based on cluster level or according to the time of day, but also the correlations of try-ons based on color, size, or price of the items (Al-Kassab et al., 2013). Tamura, Inaba, Nakamura, Kokuryo, and Murai (2010) propose data analytics methods using RFID-enabled customer purchasing behavior data and

Please cite this article as: J. Chongwatpol, Integration of RFID and business analytics for trade show exhibitors, European Journal of Operational Research (2015), http://dx.doi.org/10.1016/j.ejor.2015.01.054