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RFID Service Provider Selection: An Integrated Fuzzy MCDM Approach

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Abstract: The Radio Frequency Identification (RFID) technology supports companies to optimize business processes and reduce operational costs by knowing an item's condition and location in the inventory. RFID applications expand on the basis of speed, security and correct information flow; however, selecting the most suitable RFID service provider presents a challenge. This article offers an integrated multi-criteria evaluation framework for selecting the most suitable RFID service provider by applying Fuzzy Axiomatic Design (Fuzzy AD) and Fuzzy Analytic Hierarchy Process (Fuzzy AHP) techniques with Group Decision Making (GDM) approach. A case study is conducted and the results are discussed through a sensitivity analysis and a comparative evaluation with fuzzy TOPSIS. It is observed that an alternative RFID service provider that does not meet the defined Functional Requirements (FRs) is directly eliminated by Fuzzy AD, whereas fuzzy TOPSIS ranks it as an eligible one. The sensitivity analysis demonstrates that if FRs are low enough, the outcome of Fuzzy AD and fuzzy TOPSIS do converge, underlining the goal-oriented advantage of Fuzzy AD. The paper contributes to literature by presenting a novel approach for incorporating subjective and often conflicting linguistic evaluations of a decision committee into a solid decision support model approach for selecting the most suitable RFID service provider.

Keywords: RFID; Service Provider Selection; Fuzzy Analytic Hierarchy Process; Fuzzy Axiomatic Design; Group Decision Making.

1. Introduction

Companies competing globally are continuously seeking improvements and new technologies to optimize their business processes and reduce operational costs for better competitiveness and effectiveness. As an Information Technology (IT) solution, Radio Frequency Identification (RFID) can present opportunities to businesses for better decision making. RFID is also useful for the efficient collection and management of product information that depends on location and is generated by suppliers, distributors, retailers and end-customers [1,2]. In the RFID technology, each physical object is given a unique identification number which is used to connect that product to an information service, where all the information associated to that physical object is stored and used [3]. RFID enables the alignment of supply chain workflow with physical flows and the tracking (downstream) and tracing (upstream) of goods, leading to better visibility [1,4,5].

RFID applications in the industry can be history-oriented or real-time monitoring applications, both of which support decision making processes. Extensive information flow provided by RFID systems helps the decision making processes in terms of strategic investments and operations, including optimization of logistics, customer requirements, better control and acceleration of lead time [6]. Complementary benefits are, inter alia, improved accuracy and visibility for inventory management, status of orders, asset tracking, reduced costs for logistics operations, higher customer satisfaction, better forecasts, reduced stock outage, shorter maintenance, tracking, warranties and product recalls at item level, greater flexibility in production planning, improved utilization of resources, increased productivity, better tracking for stolen and counterfeit goods and improved shipment reliability [6–9]. Based on these reasons, RFID is a popular technology among businesses.

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