

Fuzzy ANP Model for Evaluating the Potential of Industry 4.0 Technologies in End-of-Life Aircraft Recycling

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Abstract

Industry 4.0 applications have received little attention in the context of end-of-life aircraft treatment, despite their potential to enhance the value of end-of-life products. These applications can facilitate the prediction of a product's remaining useful life and fatigue, track and exchange data in real time, strengthen partnerships in the reverse supply chain, and improve resource recovery. This research aims to assess the implications of Industry 4.0 technologies, such as blockchain, artificial intelligence and collaborative robots for enhancing circularity of the aircraft considering the sustainability criteria. A fuzzy analytical network process framework is proposed to evaluate the technologies based on a multicriteria approach as well as the interrelationships among criteria and sub-criteria. The fuzzy methodology allows decision-makers to handle the uncertainty involved in assessing alternatives across different criteria. The key criteria and indicators for the evaluation of Industry 4.0 technologies are also identified based on the triple bottom line and the technology performance. The value of this approach is illustrated by a numerical example.

Keywords

Fuzzy ANP, End of Life Aircraft, Recycling, Sustainability, Industry 4.0

Biographies

Ghita El Anbri is a Ph.D. student in the Department of Mathematical and Industrial Engineering at Polytechnique Montreal, Canada. She is interested in end-of-life management, industry 4.0 and 5.0, life cycle assessment and multi-criteria decision models. She is working with her supervisor Dr. Samira Keivanpour on the problem of aircraft revalorization using the possibilities offered by Industry 4.0 technologies.

Samira Keivanpour is an assistant professor in the Department of Mathematical and Industrial Engineering at Polytechnique Montréal, Canada. She conducts research on sustainable solutions for supply chain and logistics management, with a focus on end-of-life product treatment, circular manufacturing, and the integration of Industry 4.0 technologies.