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## EVALUATION OF ECO-EFFICIENCY BY MULTICRITERIA DECISION ANALYSIS. CASE STUDY OF ECO-INNOVATED AND ECO-DESIGNED PRODUCTS FROM RECYCLABLE WASTE

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### Abstract

Until now, humanity has strived to make efforts for warranting the economic development on a sustainable way for well-being improvement, simultaneously with resource preservation and environmental protection. The industrial production processes, which generate added value and ensure people welfare are in connection with the environment regarding resource consumption and waste generation.

In order to work on a sustainable basis, industry should attain a balance between economy, ecology and community, in the long run. One way in which industry may depend not as much of natural resources and could reduce the environmental impacts is to improve its efficiency in using materials by recycling waste in a closed loop, in line with the principles of the circular economy.

It is largely recognized that economic efficiency - simultaneously with reducing environmental impacts are promising when they are guaranteed in the early phases of any process/product synthesis and design. Therefore, eco-innovation and eco-design are tightly connected with process/product/service eco-efficiency. Eco-innovation (ecological thinking or re-thinking) is related to all forms of innovations (technologies, products, services), which are able to bring new and robust business opportunities and benefits for the environment in terms of resources and impacts. Eco-design (sometimes denoted as environmental redesign) is a fully integrated design activity in which the environmental impact is checked against targets for improvement. The results of eco-innovation and eco-design application to close the cycles using production waste as resource need to be evaluated in terms of economic and environmental performance comparative with the conventional pathway.

Given these features, we applied the Multicriteria Decision Analysis (MCDA) to evaluate the eco-efficiency of a re-thought and re-designed product based on eco-innovation and eco-design approaches, using waste production resulted from corrugated board and cardboard box manufacturing as raw material, and comparing it with the original, which is made from corrugated board sheets.

*Key words:* closed loop, corrugated board, Multicriteria Decision Analysis, production waste, resource

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