

OUTRANKING MATRIX-BASED COMPARATIVE STREAMLINED ENVIRONMENTAL LIFE-CYCLE ASSESSMENT OF DIFFERENT PACKAGING MATERIALS OF AN INDUSTRIAL SYSTEM

Jesuniño R. Aquino, jreyesaquino@yahoo.com
Raymond R. Tan, Ph.D, natdnomyar@yahoo.com

Energy insufficiency, high solid wastes generation and inadequate water supply are some of the major reasons why various manufacturing industries are now looking for ways on how to improve their product in terms of processes and materials. These steps in environmental awareness include greening of supply chain, which comprises not only the direct raw materials used but also the packaging materials needed, whether primary or secondary. One of the problems encountered in selecting which among the several alternatives will be more environment-friendly is choosing the most appropriate methodology. Life cycle assessment (LCA) is now being utilized as a tool for the selection of the best environmental option for an industrial system, which assess the environmental inflows and outflows from a cradle-to-grave perspective. It can be applied to product design through comparative LCA of different environmental options attributed to the product known as Design for Environment (DFE). Comparative LCA for DFE requires the utilization of Multicriteria Decision Making (MCDM) in which PROMETHEE algorithm was identified as a suitable and most efficient method based from the assessment of LCA practitioners.

In this study, a combined streamlined LCA model was developed for the comparative analysis of different secondary packaging materials used by a company that produces consumer products to determine which is the best environmental option with the use of PROMETHEE algorithm as a multicriteria decision aid for the ranking of these alternatives. Secondary packaging materials such as corrugated paperboard boxes, polypropylene plastic cases, and high-density polyethylene plastic cases were evaluated focusing on embodied energy, solid waste generation and water consumption coded in a spreadsheet environment.

Results of the assessment showed that for single usage of the materials, corrugated paperboard box is considered the best option based on the all the specified criterion and is unanimous on all the tested scenarios. For multiple-use of the materials, reusable plastic cases are then considered the best alternative. Using the plastic cases twice could reduce all the environmental impact indicated by at least 50%. Increasing further the number of reuse would diminish the environmental impact contributions of the plastic cases. The contributions of all the alternatives on all the environmental impact categories are in break even point to at least 4 reuses.

These results were validated using previous LCA studies and the company's decision. Other MCDM methodologies were compared to PROMETHEE and showed almost similar results. Finally, it can be concluded that the chosen methodology is the best among other approaches since it gives reliable results and is easy to use.

Contact Information: Chemical Engineering Department - Environmental Engineering Program
De La Salle University-Manila
2401 Taft Ave., Manila, Philippines
Tel. (+632) 524-0563
Cell (+63) 917 8245937

