

Holistic Simulation-Based Impact Analysis Framework for Sustainable Manufacturing

Authors : Mijoh A. Gbededo, Kapila Liyanage, Sabuj Mallik

Abstract : The emerging approaches to sustainable manufacturing are considered to be solution-oriented with the aim of addressing the environmental, economic and social issues holistically. However, the analysis of the interdependencies amongst the three sustainability dimensions has not been fully captured in the literature. In a recent review of approaches to sustainable manufacturing, two categories of techniques are identified: 1) Sustainable Product Development (SPD), and 2) Sustainability Performance Assessment (SPA) techniques. The challenges of the approaches are not only related to the arguments and misconceptions of the relationships between the techniques and sustainable development but also to the inability to capture and integrate the three sustainability dimensions. This requires a clear definition of some of the approaches and a road-map to the development of a holistic approach that supports sustainability decision-making. In this context, eco-innovation, social impact assessment, and life cycle sustainability analysis play an important role. This paper deployed an integrative approach that enabled amalgamation of sustainable manufacturing approaches and the theories of reciprocity and motivation into a holistic simulation-based impact analysis framework. The findings in this research have the potential to guide sustainability analysts to capture the aspects of the three sustainability dimensions into an analytical model. Additionally, the research findings presented can aid the construction of a holistic simulation model of a sustainable manufacturing and support effective decision-making.

Keywords : life cycle sustainability analysis, sustainable manufacturing, sustainability performance assessment, sustainable product development

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