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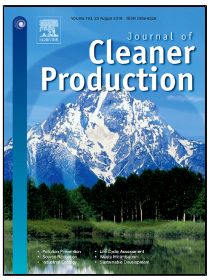


Creating value with less impact: lean, green and eco-efficiency in a metalworking industry towards a cleaner production

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# Creating value with less impact: lean, green and eco-efficiency in a metalworking industry towards a cleaner production

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## Abstract

It is possible to create value with less environmental impact through the adoption of Lean and Green manufacturing concepts and tools. This paper proposes a Lean-Green model based on the application of the Single Minute Exchange of Die (SMED) combined with Carbon Footprint (CF) to analyze eco-efficiency of a machining center in a case study in Brazil. The novelty of this paper was the proposal of a Lean-Green model based on ecoefficiency indicators to measure performance of production systems toward a cleaner production. The developed Lean-Green model should be used by companies with low-capacity of production due to restrictions of machine availability. The case study was organized in five different scenarios by varying machine tools, workers and workpieces. First, the SMED tool was applied in the setup activities and gains of reduced idle times were up to 88%. CF results were reduced up to 81% after applying the SMED tool on each scenario. Lastly, an eco-efficiency set of indicators were used to combine results of SMED and CF, and results of eco-efficiency were 3% higher even with higher CF values after converting setup saved time into productive time. To achieve such results simple improvements were performed in the machining center, through the standardization of work and the study of time and methods for setup activities, showing that the proposed Lean-Green model could be also adopted by other companies to create value with less impact.

## Keywords

Eco-efficiency; Carbon Footprint; Quick Changeover Tool; SMED; Lean Manufacturing; Green Manufacturing.