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Daria Battini, Christoph H. Glock, Eric H. Grosse, Alessandro Persona, Fabio Sgarbossa

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Ergo-lot-sizing: An approach to integrate ergonomic and economic objectives in manual materials handling

Daria Battini[1], Christoph H. Glock[2], Eric H. Grosse[2], Alessandro Persona[1], Fabio Sgarbossa[1*]

[1]Department of Management and Engineering, University of Padova, Stradella San Nicola 3, 36100, Vicenza, Italy

[2]Institute of Production and Supply Chain Management, Technische Universität Darmstadt, Hochschulstr. 1, 64289 Darmstadt – Germany

daria.battini@unipd.it

glock@pscm.tu-darmstadt.de

grosse@pscm.tu-darmstadt.de

alessandro.persona@unipd

fabio.sgarbossa@unipd.it

[*]Corresponding Author: FABIO SGARBOSSA. Department of Management and Engineering, University of Padova, Stradella San Nicola, 3, 36100 Vicenza, Italy. Phone: +39 0444 998819.
E-mail: fabio.sgarbossa@unipd.it

Abstract

Over the last decades, academics and practitioners have paid much attention to lot-sizing, which determines economic order and production quantities by balancing inventory holding and setup costs. Recently, researchers have started to integrate sustainability issues into lot-sizing models. The focus of these works has been on environmental and economic dimensions of sustainability, however, while only few contributions studied the social aspect of this problem. Especially in in-house logistics, where a high amount of manual material handling is performed, lot-sizing decisions can have a significant impact on workload and human performance, which can have a strong influence on ergonomic parameters and thus worker welfare.

The paper at hand extends previous research on ergonomic lot-sizing and introduces a new mathematical model that integrates ergonomic and economic aspects. A rest allowance function is used to take account of recovery periods that help to maintain low levels of fatigue and ergonomic risks. As recovery periods represent non-productive time, the developed integrated model permits to estimate the economic impact of different workload levels. Finally, the model is applied in a numerical study, reflecting a typical manual material handling process. Based on the results of a parametrical analysis, we illustrate the applicability and validity of this approach to different industrial contexts.