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Evaluation of Batch Splitting in the Context of Load Scattering

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Abstract : Production companies are faced with an increasingly turbulent business environment, which demands very high production volumes- and delivery date flexibility. If a decoupling by storage stages is not possible (e.g. at a contract manufacturing company) or undesirable from a logistical point of view, load scattering effects the production processes. 'Load' characterizes timing and quantity incidence of production orders (e.g. in work content hours) to workstations in the production, which results in specific capacity requirements. Insufficient coordination between load (demand capacity) and capacity supply results in heavy load scattering, which can be described by deviations and uncertainties in the input behavior of a capacity unit. In order to respond to fluctuating loads, companies try to implement consistent and realizable input behavior using the capacity supply available. For example, a uniform and high level of equipment capacity utilization keeps production costs down. In contrast, strong load scattering at workstations leads to performance loss or disproportionately fluctuating WIP, whereby the logistics objectives are affected negatively. Options for reducing load scattering are e.g. shifting the start and end dates of orders, batch splitting and outsourcing of operations or shifting to other workstations. This leads to an adjustment of load to capacity supply, and thus to a reduction of load scattering. If the adaptation of load to capacity cannot be satisfied completely, possibly flexible capacity must be used to ensure that the performance of a workstation does not decrease for a given load. Where the use of flexible capacities normally raises costs, an adjustment of load to capacity supply reduces load scattering and, in consequence, costs. In the literature you mostly find qualitative statements for describing load scattering. Quantitative evaluation methods that describe load mathematically are rare. In this article the authors discuss existing approaches for calculating load scattering and their various disadvantages such as lack of opportunity for normalization. These approaches are the basis for the development of our mathematical quantification approach for describing load scattering that compensates the disadvantages of the current quantification approaches. After presenting our mathematical quantification approach, the method of batch splitting will be described. Batch splitting allows the adaptation of load to capacity to reduce load scattering. After describing the method, it will be explicitly analyzed in the context of the logistic curve theory by Nyhuis using the stretch factor α1 in order to evaluate the impact of the method of batch splitting on load scattering and on logistic curves. The conclusion of this article will be to show how the methods and approaches presented can help companies in a turbulent environment to quantify the occurring work load scattering accurately and apply an efficient method for adjusting work load to capacity supply. In this way, the achievements of the logistical objectives are increased without causing additional costs.

Keywords : batch splitting, production logistics, production planning and control, quantification, load scattering
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