Applying work flow control in make-to-order job shops

This paper considers work flow control within a make-to-order job shop, which in this presentation differs from either a just-in-time (JIT) or make-to-inventory system because finished goods due dates are externally determined and early delivery of finished goods is prohibited. In particular, this paper considers the cross-effects of both choice of work flow control method and queue discipline at each work center. An experimental approach, using discrete event simulation, evaluates a five work center job shop with independent, randomly selected process sequences and process times over an experimental matrix of four work flow controls (uncontrolled, Kanban, CONWIP, and POLCA) and three queuing disciplines (first come first serve, shortest operation processing time, and earliest operation due date). Statistically significant comparisons demonstrate that while shop inventory (partially complete orders) is reduced through work flow control, the total inventory of pending, incomplete, and held finished goods orders increases. Further, the choice of queue discipline is far more significant than the choice of work flow control method. This paper contributes a detailed performance analysis of a relatively new work flow control method, "paired overlapping loops of cards" or POLCA. Additionally, this paper explains "lockup," a previously unreported terminal system blocking behavior. A management method to prevent occurrence of lockup is provided. (C) 2012 Elsevier B.V. All rights reserved.