On the transition from make-to-stock to make-to-order

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September 15th, 2023. University of Bath, School of Management

Abstract

From a number of recently conducted value stream mapping (VSM) exercises we have realised there are at least two replenishment decisions, and three different lead times, in the manufacturing echelon of a supply chain. This is in contrast to the common modelling assumption where only one replenishment decision with one lead time is present per supply chain echelon. The first replenishment decision releases production orders to the shop floor to maintain control of the finished goods inventory (FGI) from which customer demand is satisfied. The second replenishment decision places orders to the supplier to replenish the raw materials inventory (RMI). The three different lead times are: a) The lead time experienced by the customer − the time between the customer placing an order and that order being satisfied from FGI. b) The production lead time − the time from releasing a production order to the shop floor pacemaker and that order being completed and the product arriving in the FGI. c) The supplier lead time − the time from placing an order onto a supplier, and that order being received into the RMI. With this understanding, we develop a new stylized model of a manufacturer based on a set of difference equations. This allows us to develop both a z-transform transfer function model (facilitating a variance ratio analysis via discrete control theory) and a simulation model in Excel (to verify our work). Our parsimonious model is general enough to capture the rich dynamics of both make-to-stock and make-to-order settings. First order auto-regressive demand reveals how the three lead times influence the value stream dynamics. Finally, we analyse the economic impact the lead times have on inventory costs.

Key words: Value stream mapping, Bullwhip effect, Net stock amplification, Order-up-to replenishment policy, Make-to-stock, Make-to-order

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About the presenter

Stephen Disney's research interests involve the application of control theory and statistical techniques to operations management and supply chain scenarios to investigate their dynamic, stochastic, and economic performance. Stephen has a particular interest in the bullwhip effect, forecasting, and inventory management. Stephen has advised several of the world's largest corporations on the bullwhip effect and his research has influenced the material flow of at least 1 in every 7 pounds of UK retail sales. He has worked with many companies in the UK, US, and Europe and on supply chains that operate globally.

Stephen Disney is currently a Professor of Operations Management within the Management department at the University of Exeter Business School. Recently he was the Head of the Science, Innovation, Technology and Entrepreneurship (SITE) department within the Business School from 2020-2022. Professor Disney is currently the Director of the Center for Simulation, Analytics, and Modelling. Previously Professor Disney worked at Cardiff Business School, where he was Head of the Logistics and Operations Management department from 2012-2015 and Director of the Logistics Systems Dynamics Group from 2016-2019.