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Simulation of production setup changes in an SME

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Abstract

This case study demonstrates how a simple simulation model can help Small and Medium Size manufactures to identify current and future possible problem areas and assist management in taking the best possible decisions regarding future production strategies

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1. Introduction

This paper focuses on a case study in a global Danish SME producing advanced machinery with an increasing level of customization thus having a complex logistic and production setup. The demand is characterised by seasonal fluctuation which has lead the company to pursue a level strategy. A large inventory

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of finished products has therefore been built up over the last years, but the development toward increased customization has made it difficult to predict which products to store.

The goal of the present study is to find new ways of leveling the manufacturing and introducing mass customization techniques. Simulation was used to analyze the effect of moving the customer order decoupling point forward in terms of inventory level and resource consumption in the pre- and final assembly areas (as described by Hoekstra & Romme [1]. Discrete-event modeling and simulation is a popular tool in widely varying fields for identifying and answering questions about the effects of changes on processes [2].

2. Case Company description

The company produces large modular industrial machines consisting of standard units, standard equipment and special parts. The design is modular to achieve maximum individual customization while minimizing cost through creation of modular components that can be configured into a wide variety of end-products and services [3,4,5].

A typical machine consists of 6-7 modules of which 95 percent are based on standard components and units while 5 percent are customized. The production is thus a combination of batch and order production, both at the level of components, units and finished goods.

Under periods of stable demand the company would pursue a conventional postponement strategy as described by Hoek et al. [6] where generic modules are pushed and customized configurations and components are pulled which in Lample and Mintzberg's framework [7] can be described as standardized customization. However, there are significant variations in demand.

And when demand is low, generic machines are being configured and produced to stock according to the sales department's estimation of future orders. The movement of the decoupling point presents a challenge as the product and the manufacturing system is designed for a specific level of assembly and once this level is surpassed a number of decisions are made which will define the capabilities and hence limit the number of potential customers.

The number of modules and variants has increased significantly during the last years which further complicate building machines for inventory. The company operates with 12,000 items divided equally between purchased and in-house manufactured. Standard delivery time is 6 weeks of which 2 weeks are for order specification and 4 weeks remain for assembly and test. If a high degree of customization is requested the delivery time is prolonged.

The company differentiates from competitors through leading edge technologies and a high degree of customization. The strategy is to be 1-2 years ahead of competitors, which again means that the products are in a high price range.

2.1. Production and assembly

Planning takes place at four levels involving varying planning horizons:

- 1 year horizon (S&O plan) based on forecasted sales per month
- 3 month horizon (unit plan) based on actual orders and the S&O plan
- 6 week horizon (standard and customized parts) based on actual orders
- 1 week horizon (detailed materials and capacity plan)

In addition, daily meetings are held where operation managers, head of planning and foremen discuss the current situation. The planning department launches approximately 500-600 orders per month of which 5% are rush orders. The planning department is in serious need of one overall/integrated information system to

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