

# Framework and Interdependencies Analysis for Customer Order Behavior in the MTO-MTS Environment\*

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## *Abstract*

This paper presents a conceptual model for aiding in the design of mixed Make-to-order (MTO) and Make-to-stock (MTS) Manufacturing Planning and Control (MPC) systems. A literature review of methods and techniques for MPC in MTO-MTS, shows that the current methods are either case specific and limited in general applicability or narrowly focused on shop-floor control mechanisms. To close this gap a framework for mixed MTO-MTS MPC is presented and it is discussed that further design analysis needs to be done before selected the most appropriated methods and techniques for integrating the mixed MTO-MTS manufacturing planning and control environments. By using the recommended interdependencies analysis a first step is taken towards designing a MPC system by matching the MTO and MTS planning approaches in a situational manner. While the paper offers a framework in mixed MTO-MTS planning and control, it also gives a greater insight, thought the interdependencies analysis, for designing mixed MTO-MTS MPC systems. The main contributions are the conceptual framework and the proposed analysis tool. This holds value both for practitioners and for academia.

*Key words: Production, Make-to-stock, Make-to-order, Manufacturing Planning and Control, Design Analysis.*

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## **1 Introduction**

A good Manufacturing Planning and Control (MPC) approach is vital for companies' ability to survive and thrive in competitive market situations [12]. In practice many companies are operating as mixed MTO and MTS. The mixed MTO-MTS manufacturing environment is often found in companies producing to several markets or products at varying stages of their product life cycle (PLC) in the same manufacturing system. For this reason recent research has begun to look into the mixed manufacturing environment with both a MTO and a MTS [25, 26, 27, 33] approach in the same manufacturing planning and control system.

While there are several frameworks for designing pure MTO and MTS MPC systems [4], there seems to be lacking a framework to aid in the design of the mixed MTO-MTS MPC system addressing the whole planning hierarchy. The current-state of research into mixed MTO-MTS MPC approaches is limited to narrow case studies or shop floor decision routines. The insufficiency of mathematical approaches in solving the MTS-MTO issue has been noticed [25], the main reasons being the difficulty of modeling the problem accurately.

There appears to be a gap between established recognized guidelines in literature and the practical approaches implemented in industry. To assist in closing this gap a framework and interdependencies analysis are presented in this paper. The framework offers a new perspective on the impact of customer orders on planning

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