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The effects of manufacturing control strategies on the cash conversion cycle in manufacturing systems

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Abstract

It is a common practice to measure the performance of a manufacturing system using common production management criteria such as cell performance metrics or general operations management metrics among engineering management/business administration practitioners. However, most of the time, these performance measures do not truly reflect company's financial performance. It is not unusual to see a well performing operational strategy in terms of one or more cell performance metrics fail to produce the same level of financial performance. The aim of this study is to investigate the effects of the two most common manufacturing planning and control strategies, namely push and pull, on the cash conversion cycle (CCC) in a manufacturing system. The CCC is an important measure of the length of time between cash payment for the purchase of resalable goods or an investment made for production and the collection of accounts receivable generated by the sale of those purchased/produced goods. We have simulated a hypothetical multi-stage manufacturing system that is run under either push or pull control systems to measure the effects of these systems on the financial performance of the company. We used deterministic master production scheduling for the simulated production period to eliminate the variation generated by randomness so that a one-to-one comparison between manufacturing control strategies is made possible. We analyse the results generated by the two control strategies to understand their effects on the CCC and draw conclusions.

Keywords: Cash conversion cycle; Push; Pull; CONWIP; Inventory cycle

1. Introduction

The optimum level of working capital will vary depending on the industry in which an organization operates and the nature of its transactions (Walker, 1964; Outram, 1997). It is the responsibility of the operations manager to maintain inventory (material, work in process (WIP), finished goods, and consumables) at optimum levels to meet due dates, minimize production leadtime, and maximize throughput while producing high-quality products with minimal or zero defective or rework, so as to avoid the unnecessary transfer of funds from working capital into rework, subcontracting, wasted capacity, and/or to extra capacity, such as overtime and extra shifts needed to allow for timely work completion. However, operations managers often think they are responsible for a specialized portion

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of the business only and may regard the cash position as being completely beyond their control and something for the financial managers to worry about (Mehta, 1974). It is unfortunate that the top management of many manufacturing organizations gives far more attention to pure accounting and budgetary control than to cash management and thus working capital control. Operations management, therefore, is denied any responsibility for self-financing even though the profit is earned on the shop floor (van Horne, 1984; McKosker, 2000).

Operations managers often make reasonable subjective forecasts of the operating variables they are responsible for. However, it is difficult for them to translate this knowledge into a cash flow forecast, since most operations planning activities are not guided by the tools of finance, and operational and financial analyses are not reconciled. Moreover, much of the literature on operations planning and control seems extremely näive from a financial point of view. On the other hand, financial analysis diverts attention from, and sometimes actively undermines, real shop floor operations strategies. Some even argue that finance theory determinedly ignores operations planning and control system implemented on the shop floor (Grass, 1972).

Numerous papers have been published on manufacturing planning and control (MP&C) implementation. MRP-based push and JIT-based pull systems are the two best-known planning and control strategies worldwide (Huang and Kusiak, 1998; Baykoc and Erol, 1998; Thesen, 1999). A review of MP&C implementation studies reveals that little or no recognition has been given to the adaptation of accounting systems to meet the information needs generated by the MP&C strategies. Cooper and Kaplan (1988) argue that management accountants must develop accounting systems that support the changing manufacturing environment and manufacturing control strategies. Moreover, performance measurement is a critical aspect of management accounting systems within an MP&C environment, since inappropriate performance measures not only misrepresent, but also undermine, MP&C efforts (Cooley, 1996).

In addition, the relevance of traditional standard costing systems for the purpose of performance measurement in an MP&C environment is questionable. For example, the use of efficiency variances may encourage production for inventory rather than meeting demand. A possible consequence of the use of this type of measure is that inventories of WIP and finished goods will accumulate, contrary to the goal of inventory elimination, which is a central theme in all MP&C strategies.

Manufacturing performance measures that relate to the financial needs and goals of the organization should also be introduced. As production processes become more tightly linked through the elimination of non-value-adding activities, timely financial feedback to the shop floor becomes essential.

Cash inflows and outflows are usually the consequences of operating decisions. Although the finance manager has direct responsibility for managing "cash", the operating activities that generate the cash flows are frequently controlled by others in the organization.

Research in the area of financial performance of manufacturing organizations is limited and mostly focuses on product cost modelling (Malik and Sullivan, 1995). In the 1990s, the direction of this research moved towards activity-based cost modelling, focusing especially on cost modelling in automated manufacturing systems (Spedding and Sun, 1999; Takakuwa, 1997; Koltai et al., 2000), even though available information on how cost items are apportioned is limited, as is the information reported at the production line.

Moreover, this research is overwhelmingly from the financial point of view and deals mostly with designing cost systems for manufacturing organizations to enable them to identify the cost sources better, so that improved cost control mechanisms can be established. Such research assumes that manufacturing lines work under perfect conditions: there are no machine breakdowns, no delays occur, no bottleneck constraints exist, materials are always available, WIP and inventory levels are always negligible. It is also assumed that production environments are deterministic and that part entry and processing times are always predictable. However, reality is very different and the harsh facts of life on the factory floor render all these assumptions unjustifiable. The authors have found only a few publications that consider the effects of manufacturing variability on system's financial performance (Fry et al., 1998; Taylor III, 1999; Leitch, 2001; Boyd et al., 2002; Farris II and Hutchinson, 2002).

To the best to our knowledge, this is the first full-scale study that considers, through cost and financial models, shop floor strategies and realities under different operational conditions in relation to financial performance; particularly in relation to