

Balancing Efficiency and Flexibility in Shop Floor Scheduling

Shop floor scheduling is among the most complex aspects of modern manufacturing, yet it holds the key to improvements in efficiency that may present the manufacturer's greatest opportunity to improve profitability in today's difficult economic circumstances.

In its simplest terms, shop floor scheduling is the deployment of raw materials, equipment and people to manufacture a product at the lowest possible cost in the shortest possible time frame. The complexity arises from the myriad variables that are a part of today's manufacturing environment. Not only are the products, processes and types of equipment numerous, but they are also subject to multiple variations in operational sequencing. And each operation in the sequence may have its own requirements for time and materials.

An effective schedule both affects and is affected by virtually every area of the manufacturing operation, from research and sales through production planning and shipping. The overall system needs to be efficient, but it also must be flexible to meet changing demands. Balancing the needs for efficiency and flexibility lies at the heart of the challenge of shop floor scheduling.

Performance Criteria

Effective scheduling begins with fixed performance criteria established with a clear eye toward obtaining maximum profitability. Specific standards that companies target to meet that goal vary depending on the nature of the operation.

Take a minute to think about your company's performance criteria. Do you set goals based on a goal of timely delivery? Efficient machine use? Low total cost? Reduced set-up time? Minimum inventory expense? Low overtime cost?

The answer usually depends on whether yours is a classic job shop, an open job shop, a batch shop, a flow shop, a manufacturing cell operation or an assembly and transfer system.

In the classic job shop, for example, production typically is organized around a build-to-order plan. The system is characterized by high product variety and small lot sizes — perhaps as low as a single lot. These operations usually have no work-in-process inventories and they rely on a fixed, one-direction process flow. Sequencing of operations is a significant scheduling concern in a classic job shop because work and materials must be released in the right order for top efficiency.

Balancing Goals

In any operation, schedulers continually weigh performance criteria against one another. In a system with sufficient orders to maximize use of equipment capacity, scheduling focuses on timely delivery. A system that relies on adding overtime to create flexibility of capacity must balance timely delivery goals with minimizing overtime.

Due dates often drive scheduling decisions, but the importance of the due date may vary. In some settings, a certain measure of lateness is acceptable if it helps meet other goals, such as capacity utilization. But in a just-in-time operation, any tardiness is unacceptable because it could shut down an entire operation.

Performance measures must be quantifiable and trackable over time. To measure timely delivery, for example, the metric can be stated as a number of days or

weeks. For costs, the metric would be expressed in dollars. Machine utilization can be measured in a ratio of use to capacity.

Evolution or Revolution?

Scheduling processes usually result from an evolutionary process. As manufacturing operations change, schedules adapt to keep pace, perhaps with increases in staff or upgrades in software. In some cases, manufacturers may build in more lead time, even though shortening lead times is usually one of the goals to improve efficiency.

Sometimes manufacturers reach the point where the evolutionary process is no longer effective. It may be more appropriate to step back from the entire system and revolutionize it. Reworking it from top to bottom can help ensure that the scheduling process uses the right tools and tracks the right information.

To redesign a scheduling process, manufacturers typically begin by assembling a multidisciplinary team to examine scheduling needs. The team identifies appropriate performance metrics, selects a preliminary approach and determines the data requirements. As the project moves along, the team will refine the approach, determine how to implement changes and design a training system.

Manufacturers that tackle the scheduling challenge simply by adding or replacing software may be disappointed because of a failure to align the software with the needs of the manufacturing process. An examination of the scheduling process is an important first step in evaluating the profitability of your shop floor operations and determining the opportunities you may have for improvement.