SPEED TO MARKET

A Newsletter for
Job Shops–Niche Manufacturers–Focused Distribution Systems
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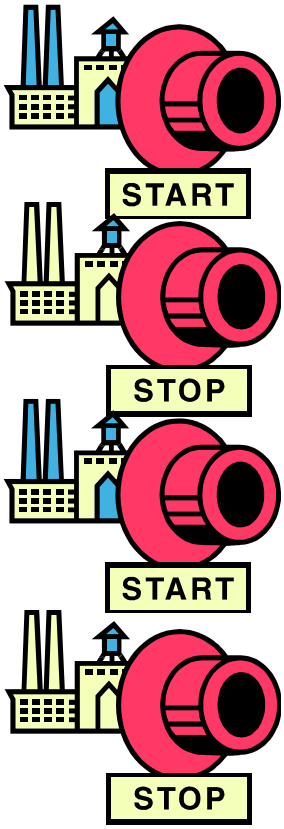
How Much Do Schedule Changes Really Cost? (Part 2)



In the July issue of the Speed to Market Newsletter we examined the cost factors that come into play during unscheduled changes. We estimated costs could run as high as three to four times direct labor when lost revenue, the cost of disruptions, and other hidden costs are included. In this article, we offer tools you can use to examine the situation in your shop, and formulate strategies for improvement that will have a direct, positive impact on performance and profitability.

Note: We always like to tie performance and profitability together because the former drives the latter. Profit is not the goal *per se*; it is feedback that indicates your business system is functioning at a level that creates wealth. Profitability says your business strategy, marketing, sales, pricing, production efficiency, quality, lead time, customer service, staffing, and other competitive factors are in tune and working together.

Ratio Delay Study: One way to determine the magnitude of this problem (or to determine if it really is a problem in your shop) is to conduct a ratio delay study, a statistically-based sampling tool.

Here's what you do. Create a matrix with your most heavily used machines in the left column, and time intervals as headings for the balance of the columns. It will look something like this:

Time																											
Okuma																											
Makino																											
Hurko																											
Mazak 1																											
Mazak 2																											
Mori Seiki																											

Put this matrix on a clipboard near the door that goes into the shop. Every time someone goes out on the floor, they take the clipboard with them and note the status of each machine. A machine is either: 1) running and productive, 2) being changed over (scheduled); 3) being changed over (unscheduled), 4) being re-set up because a job was not completed; or 5) is idle. Write the appropriate code in the cell to indicate the status of the machine when it was observed. Enter the time the observations were taken in the column heading.

At the end of the day, you will have a matrix that looks something like this:

Time	7:00	7:30	8:00	8:20	9:05	9:45	10:20	10:55	11:30	12:00	12:45	1:30	2:15	3:00	3:30
Okuma	P	P	U	U	U	U	P	P	R	R	R	P	P	P	P
Makino	I	I	S	S	S	S	P	P	P	P	P	I	I	I	I
Hurko	P	P	P	I	I	S	S	S	P	P	P	P	P	P	P
Mazak1	P	P	U	U	U	U	P	P	P	R	R	R	P	P	P
Mazak2	S	S	S	P	P	P	P	U	U	U	U	P	P	P	I
Mori	S	S	S	S	P	P	P	P	S	S	S	P	P	P	P

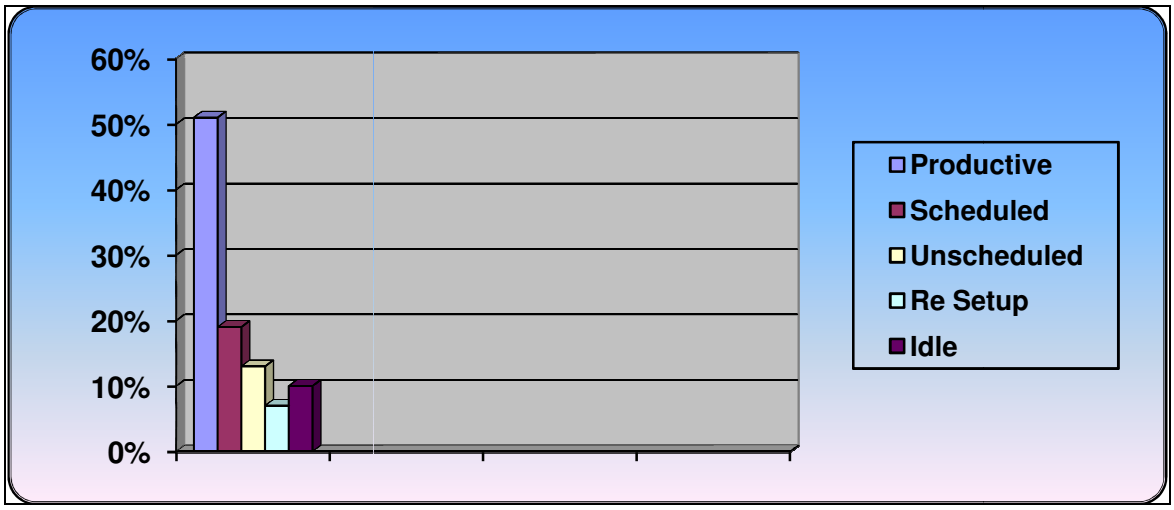
Another Option: You can either use variable time intervals as show above, or even intervals where each observation is taken at a scheduled time (e.g., 7:00; 7:30; 8:00 etc,). Assign a specific individual to take these observations. It's a good idea to take observations every day for a week or two to collect enough data for a valid sample. Also, pick a time that is typically normal for your shop (e.g., not during a period when your key customers are shut down for vacation). You could have 900-1000 observations over a two week period.

Once you have the data collected, count the number of observations by each code, and divide these by the total number of observations. Using the example above, there are 90 observations which are distributed according to the following table. This indicates the percentage of time for each.

Code	Machine Status	#	%
1	Productive	46	51%
2	Scheduled Changeover	17	19%
3	Unscheduled Changeover	12	13%
4	Re Set Up	6	7%
5	Idle	9	10%
	Total Observations	90	100%

Note: Equipment utilization is a typical measure of performance in a mass production environment where much of the work is machine paced, and lines are engineered to produce similar products at high rates of speed. However, in a job shop environment, you may have a machine that has a very low level of utilization, yet must be available when you need it. Equipment selection is not necessarily a function of how much you will use it; rather, a specific piece of equipment may be required to reduce lead-time, or reduce outsourced work and associated costs, or enable you to perform some technical operation that makes you shop more competitive. You may have a hammer in your toolbox, but that doesn't mean you have to use it all the time.

Convert this table into a graph to provide a visual perspective.



Machine Utilization: At this point, we know the percentage of time machines are: running and productive; the time is being set up, re-set up: and the time they are idle based on a sample of observations. However, before we can formulate and implement effective strategies to increase productive time, it's necessary to know the causes of changeovers. Although it's tempting to blame the customer, and there is no doubt they contribute their fair share, there are a number of other causes to consider. These can be separated into external and internal categories.

External Causes

Customer Initiated: These are changes that come about as a result of a customer's request, often to move a ship date forward. Generally, a shop will accommodate a request from a good customer, and may even charge the customer for the extra set up (but nowhere near what it actually costs).

Time and Materials Work: Many shops receive a significant portion of their revenues from time and materials work which is typically unscheduled (walk in the door work). In order to service this type of demand, it is often necessary to disrupt scheduled work.

Emergency Orders: This is similar to time and materials work, and may require breaking into scheduled work.

Increase (or Decrease) in Order Quantity: A customer may change the quantity on a job causing it to run longer on a work center than originally anticipated. This may cause other work to be rerouted through other work centers in order to meet promised ship dates.

Change in Specifications: Sometimes these are minor, and sometimes more formal engineering changes that may require a new or revised set up or process change.

Vendor Performance Failures: There are times when vendors promise delivery and fail. You could have a machine set up waiting for materials to arrive that are delayed, or arrive with quality defects. Or outside services such as heat treating or finishing are not competed on time. Vendor problems can throw you off, and cause you to reschedule jobs in production. Sometimes this requires re-setups.

Internal Causes

Equipment: A job may be set up or scheduled to run on a particular piece of equipment that can't hold tolerances or may break down. The job may be run on another piece of equipment (new set up), or may wait for a repair (risk of late delivery).

People: Absenteeism can be a cause for changing schedules. Sometimes another operator with the required skills is not available, so the job has to either wait, or has to be run on another machine.

Rework: If a job needs to go through a work center again because it was made incorrectly the first time, then the production time on that machine is not available (opportunity cost), and an additional set up may be required. If a job was scheduled on that work center and is now bumped because of the rework job, this is a further disruption that must be accommodated.

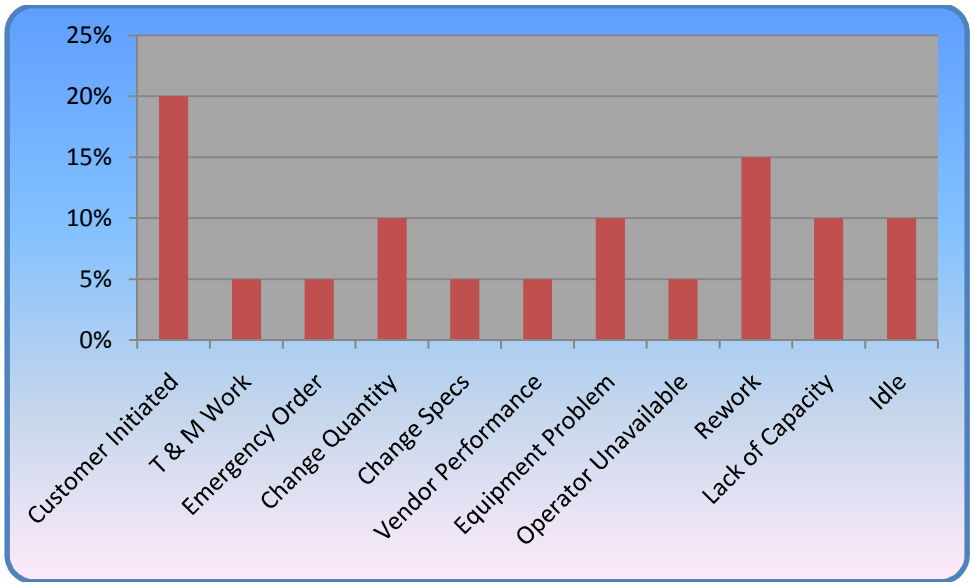
Lack of Capacity: It's not uncommon in job shops to oversell capacity, or not allow for time and materials work that is unplanned and unscheduled. This can create chaos on the floor as managers and supervisors try to figure out how to get too much work completed in too little time. Lack of capacity can be a primary driver of unnecessary changeovers and waste. For a more complete discussion of this subject, see the March 2005 issue of the Speed to Market Newsletter, You Can't Put Ten Pounds of Anything in a Five Pound Bag.

Delays: A machine may remain idle because the next job is not ready, either because the previous process step has not been completed, or because the materials have not been moved, or because no one knew the machine had to be set up, or for any number of other reasons.

Once you understand what is driving these changes, you can formulate strategies to reduce them. For example, build enough time in your schedule to handle unscheduled T&M and emergency orders. Conduct a vendor reliability study and dump the poor performers. Increase the charge for rescheduling work and tell customers why…try to talk them out of the change. Review your preventive maintenance program and measure machine downtime.

Involve your key people in brainstorming ways to reduce machine downtime. Don't forget there are two things involved…reducing the number of changeovers and reducing the time it takes for a changeover. Also, if you note the cause of the changeover when taking observations on the floor, you can build a frequency distribution by cause code.

Reason	Frequency	Percentage
Customer Initiated	40	20%
T & M Work	10	5%
Emergency Order	10	5%
Change Quantity	20	10%
Change Specs	10	5%
Vendor Performance	10	5%
Equipment Problem	20	10%
Operator Unavailable	10	5%
Rework	30	15%
Lack of Capacity	20	10%
Idle	20	10%
Total	200	100%



Value of Improvement: In this example, machines are 51% productive and 49% non-productive for a variety of reasons. The challenge, of course, is to reduce the non-productive time. This will automatically increase productive time. Let's say your normal work week for these six machines is two 8-hour shifts, 6 days a week. This is a total of 576 hours per week and 29,952 hours annually.

All sources of machine downtime add up to 49% or 14,676 hours per year. A modest 15% improvement would result in an additional 4492 hours of productive time. This is equivalent to 561 eight-hour machine shifts. What is this worth in terms of additional capacity and revenue?

Summary: This may seem like a big rigmarole to go through when you already know that you have too many changeovers, and the floor is in a constant state of turmoil. However, recall the basis for *How Much Do Schedule Changes Rally Cost* is that schedule changes can be taken for granted in a job shop environment because they come with the territory. There is no line item on your income statement that says "The Cost of Jumping through Hoops to Satisfy Customers," so it's easy to miss the true costs. The idea is to bring this to your attention as an area for improvement, and to offer some tools you can use to gain a better understanding of the causes and magnitude of the problem.

Schmald Tool & Die Continues to Improve

Long-time client Schmald Tool & Die in Burton, Michigan continues to move forward in its quest to become more competitive and develop a broader range of capabilities and services. The latest initiative is a comprehensive *Production Planning, Capacity Management, Scheduling, & Shop Floor Control System* that integrates forecasting, planning, scheduling, capacity management, and shop floor control into an integrated flow.

The development of this system was supported by a grant from the Great Lakes Trade Adjustment Assistance Center and took four months from initial conception to everyday use in running the business. General Manager Royce Mashburn who was intimately involved in developing and implementing this system (along with Production Supervisor Chris Markoff) likes the system because it "provides a snapshot of the day-to-day business." Royce estimates it takes less than an hour a day to administer.

Features and benefits of Schmald's *Production Planning, Capacity Management, Scheduling, & Shop Floor Control System include:*

- Provides visibility of all orders booked and their promised ship dates.
- Maintains an accurate real-time picture of the workload (backlog) on the shop in total and by work center.
- Prioritizes these orders by ship date by week (and by day of necessary).
- Provides forward visibility of work so that capacity requirements can be anticipated.
- Provides ample warning when an overload condition exists so that additional capacity can be brought on line.
- Provides an easy way to identify when and where a job has exceeded its estimated hours by work center. This enables the Production Supervisor to take immediate action to determine the problem (miscalculated estimate and/or a production problem on the floor).
- Machinists can be scheduled in work centers based on backlog hours and skills.
- Enables management to adapt to fluctuations in the shop workload with greater efficiency, including spikes in demand and unanticipated emergency orders.
- Enables management to adjust capacity to match workloads at individual work centers.
- Establishes workload priorities based on customer service requirements.
- Enables the maintenance of consistent lead times with variable demand.
- Enables management to determine overtime requirements at the start of a week instead of at the last minute.
- Provides employees with a forward look so they can plan their time more effectively (vs. getting last minute assignments that can be disruptive to family obligations).
- Enables management to determine the need to outsource work during periods of peak demand.

- Enables management to identify training needs among members of the workforce, and track their progress in learning new operations, when used with the flex chart option.
- Interfaces detailed planning and scheduling routines with their Vantage ERP system.
- Provides the shop floor supervisor with the tools required to change the lineup behind each work center at a moment's notice to reflect changes in priorities, and to control work on the floor with greater precision.

Laurie Moncrieff, President and Owner of Schmald Tool & Die, receives a Certificate of Achievement from Delta Dynamics for the successful implementation of a *Production Planning, Capacity Management, Scheduling, & Shop Floor Control System* to reduce lead time and provide customers with superior service. General Manager Royce Mashburn (r) and Vincent Bozzone developed and implemented the system.

A GOOD CONSULTANT ANSWERS A CLIENT'S QUESTIONS. A GREAT CONSULTANT QUESTIONS A CLIENT'S ANSWERS.

Delta Dynamics' guiding principle, *Client Driven Solutions,* can help you improve performance, profitability, and competitiveness. We custom design and implement strategies that provide solutions to your problems and enable you to achieve your objectives. If you are dissatisfied with your company's performance, and tired of trial and error fixes that don't work, call Vincent Bozzone at 248-333-0482 for a no cost, no obligation discussion of your situation.