It's About Time

The Competitive Advantage of Quick Response Manufacturing

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Appendix C

Examples of How to Think Outside the Box When Creating Quick Response Manufacturing (QRM) Cells

During the process of forming QRM Cells you can be much more creative than simply pulling together a few resources and collocating them in one area. Such creativity also results in cells that far exceed the prior performance expectations. In this Appendix, I give you examples of such thinking to stimulate similar creative thinking in your organization. I'll start by repeating the QRM Cell definition in Chapter 2. As mentioned there, this definition is written in a way that enables it to be used not just in manufacturing, but in other areas of the organization as well:

> A **QRM Cell** is a set of dedicated, collocated, multifunctional resources selected so that this set can complete a sequence of operations for all jobs belonging to a specified FTMS. The set of resources includes a team of cross-trained people that has complete ownership of the cell's operation. The primary goal of a QRM Cell team is reduction of the cell's MCT.

The challenge here is that the cell needs to "complete a sequence of operations" without the job leaving the cell. In the process of designing cells, teams often make one of the following erroneous assumptions:

- In the case of shop floor operations, if a job visits twelve different machines the team assumes that to create a proper QRM Cell they would need to move and dedicate all twelve machines to the cell. Not only will all the moving be costly, but if the factory has only one machine of a given type and if it is too expensive to duplicate, it may not be possible to dedicate it to the cell.

- Similarly, while analyzing office operations for a potential cell, if a job currently goes to seven people with differing skills, the team assumes that the Q-ROC would need to be staffed with seven people.

Instead, you should note the following advice.

RETHINK EVERYTHING WITH THE GOAL OF MINIMIZING MCT

A QRM Cell is not a mini-copy of your current operation. In designing your QRM Cell, you have a rare opportunity to rethink how you process jobs in the FTMS; once the cell is created and machines or people are moved, it will be harder to change the processing methods. As I described in Chapter 2, in most businesses, operations were designed so as to minimize cost; now your goal is to minimize time (as measured by MCT) and it is almost surely the case that the original operations do a poor job of minimizing time. So you should step back and rethink everything that you currently do for the FTMS jobs and ask the question: "If we wanted to minimize MCT for these jobs, how would we process them?" This requires plenty of brainstorming and out-of-the-box thinking by the QRM Planning Team and possibly others in the organization. However, when effectively done, the results can be amazing and eye-opening for the rest of the organization. In this Appendix, I give you some tips to help stimulate productive brainstorming by your teams and I also illustrate the tips with concrete examples. The examples are for both shop floor and office operations.

RETHINK DESIGN AND MATERIAL CHOICES

Does the design involve purchased materials with long supplier lead times, or in-house operations that can't be brought into the cell? Consider alternative designs or material choices. Here are some examples:

- Castings have long lead times but are used because they are generally less expensive when you are making large batches. However, if you are making products in small quantities, consider using bar stock or other metal stock or weldments, and machining the parts from scratch.

- Do parts need to go for heat treatment or painting in the middle of the routing sequence? Ask your engineering department to look into the use of pre-heat-treated stock or prepainted blanks.
- Similarly, if parts need to go out of the cell for plating, ask your engineers if they can switch the design to use stainless steel or another alloy that doesn't need plating.

BE READY AND ARMED TO CHALLENGE EXISTING COST TRADE-OFFS

These suggestions bring up an important point that applies throughout this process of designing QRM Cells. You should be ready to battle conventional decisions that were made to (supposedly) minimize cost. You will need to use many of the arguments throughout this book to support your alternative suggestions—do your homework ahead of time and be ready for the meetings where these suggestions will be challenged!

RETHINK THE SEQUENCE IN WHICH OPERATIONS ARE PERFORMED

This is often made possible by the fact that QRM Cells are designed around an FTMS.

In the order acceptance process at a company, jobs went to three types of "experts" who would check different aspects of the order, and only after that could the order go to Planning, Materials, and other departments to be accepted and assigned a ship date. There was only one of each type of expert at the company and they were all very busy, invariably leading to delays. Also they could not be dedicated to any one cell. When a particular Q-ROC was being designed to combine some of the office processes into a cell, the QRM Planning Team found that because the characteristics of the FTMS jobs were similar and known ahead of time, a fairly comprehensive checklist could be compiled for the salesperson to use directly with the customer. With the information obtained in advance through this checklist, there was no longer a need for the three experts, and the Q-ROC could perform the remaining tasks and accept the order in under a day.

Note that the manufacturing examples involving use of pre-heat-treated stock or prepainted blanks are also instances of this principle. Essentially you have moved the operation to the beginning of the sequence instead of in the middle of the routing.

EXPLOIT CROSS-TRAINING TO ELIMINATE STEPS

You should exploit the characteristics of the FTMS, which makes it easier to cross-train people since they are dealing with limited variations in jobs and tasks. Here are two examples:

- Let's say that today a job goes from Inside Sales to Design Engineering and then to Cost Estimating and then on to other operations. If the FTMS involves a limited set of variations to a base design, perhaps the salesperson could be cross-trained to make those changes on the CAD system and use a simple table-driven approach to estimate the cost.
- Interpreted broadly, this concept of cross-training can also be used for machines! Do parts get moved from one machine to another less expensive "cost center" for cost considerations? For example, a part might be moved off an expensive CNC machine to a manual machine to complete some operations—this appears to be cheaper using standard cost calculations. Look into whether the part can be completed on the CNC machine (can the CNC machine be "cross-trained" to do this operation through an appropriate NC program?).

FIND A SMALLER-SCALE PROCESS IMPLEMENTATION

Can you rethink design, materials, process technology, or type of machine in order use a small-scale process that can be placed in the cell? Here are examples:

- Heat treating is typically done in large furnaces in one area of a factory. However, today you can also buy small programmable ovens that can run a variety of heat treat cycles—they are as small as a household refrigerator and can be placed right in a cell.

- Parts are often painted in a large automated paint line. Not only do they travel across the factory to go to this line, but because of color sequencing on the line they might have to wait days for their turn. Ask whether the FTMS parts can be painted by an operator with a spray gun in a paint booth right in the cell, and if the quality of this operation would be acceptable. Note that you may need to explore the use of alternative paints for this to be possible, but get your engineers to brainstorm with you on this.

Note that in both the preceding examples, you will most likely need to battle conventional notions of efficiency, since traditional experts will claim that the central heat treatment or the large automated paint line are more efficient. As always, you will need to counter these claims with arguments based on the value of the resulting MCT reduction.

QUESTION THE NEED FOR THE OPERATION

This is not as ridiculous as it sounds! Over time, organizations add layer upon layer of checks, inspections, and additional processes because of problems that might have occurred in the past, and no one person has the task of reviewing all these operations to see whether they are still needed. In one situation a machined product went through two heat treat operations during its routing, the first of which had to be done in a very large facility for technology reasons. When I questioned the need for both the operations, the Engineering Department reviewed the process parameters, did a few tests, and agreed that the first heat treat operation could be eliminated and the second heat treat operation would suffice. The best part of this was that the second operation could be performed in a small oven that could be placed right in the cell.

IF THE OPERATION CAN'T BE BROUGHT INTO THE CELL, USE TIME-SLICING AT THE SHARED RESOURCE

This solution can be used for shop floor machines, office resources, and even subcontractors. Suppose a job needs to go to a large or expensive resource such as a paint line, plating line, heat treat facility, or very large milling machine. Let's say that after considering all the previous ideas the QRM Planning Team still can't find a way to modify the operation or bring the resource into the cell without incurring unreasonably high costs. Then you can still use a QRM technique called time-slicing to preserve most of the key principles of QRM. I'll use examples to illustrate how it works for several different situations.

Shop Floor Example

Let's say a job needs to leave a QRM Cell part of the way through its processing and go to a heat treat oven, after which it returns to the cell for the remainder of its operations. Suppose for technological reasons the oven cannot be downsized and placed in the cell. This oven is used by many other jobs, and there are often hot jobs and schedule changes, so jobs going to the oven don't have a short or even predictable lead time. The cell team effectively loses ownership of a job when it goes to the heat treat area, and then it can't be held responsible for meeting its MCT target. Here's how time-slicing works for such a situation. You divide the weekly schedule of the shared resource into slices and assign these slices to various cell teams—you can also leave some slices for "non-cell" jobs if you have some jobs that don't go through cells. Figure C.1 shows an example of time-slicing for a shared oven. The eight-hour slices correspond to a typical heat treat cycle including loading and unloading time. Some slices are assigned to cells and the remaining slices are unassigned and are for "other" jobs. Let's say Cell A operates only during first shift. You can see that Cell A gets a heat treat cycle twice a week, during second shift on Tuesday and Thursday. This means that the cell team can plan its work accordingly. If it completes the initial operations and delivers jobs to the oven by the end of first shift on Tuesday, those parts will be run in the oven on second shift and be back in Cell A by Wednesday morning. Thus you can see two benefits of this procedure. The first and obvious one is the fast

	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
1st Shift	Cell B		Cell B		Cell B
2nd Shift		Cell A		Cell A	
3rd Shift		Cell C		Cell D	

FIGURE C.1
Illustration of time-slicing for a shared resource.

and predictable turnaround of jobs by the shared resource. The second, less obvious benefit is that you have now given some ownership back to the team in the sense that the team now "owns" that time slice and can use it to plan its work.

Office Example

In order to respond quickly to customer requests for quotes (RFQs) you are attempting to organize your estimating and quoting processes into three Q-ROCs, each serving a particular FTMS. One major obstacle to this effort is that each of the Q-ROCs occasionally has to do a quote for a part that would require sophisticated hard-tooling to be built. This requires an evaluation by a tooling expert, but there is only one such person in the company. How can you dedicate one person to three Q-ROCs? Again the answer is time-slicing. Depending on the frequency of these quotes that need special tooling, you block out slices of time in the tooling expert's schedule and assign these slices to each Q-ROC. The expert most likely has other jobs to do as well, such as shop floor projects or longer-term product development, and those can be done in the remaining periods of time. You might argue that the time-slicing solution is not required—why couldn't the teams just call this person whenever they needed input? The answer is the same as before: predictability and ownership. Since there is only one expert in the company, this individual is likely to be busy and pulled in many directions, and teams might struggle to get time when needed, or feel they were imposing on the person if a quote was needed quickly. With time-slicing, it is clear that the particular slice of time belongs to the team, it is not "imposing" on the expert, and also the team can plan around when the expert will be available.

Subcontracting Example

A company based in Milwaukee, Wisconsin, sent some of its sheet metal parts to a subcontractor for painting. Even though the subcontractor was only 2 hours away by truck, the typical turnaround for these parts was 11 days. The reason was that this company's parts had to queue behind other customers' parts and also wait for the right paint color to come up on the paint line. As part of its QRM efforts, the company got its purchasing staff to renegotiate its contract with the subcontractor. The two parties agreed that the company would get time slices on the paint line for two mornings each week. This way the company could load its parts onto a truck the previous evening and they would be back by the next afternoon. Note that the key here is to replace a conventional "piece price" contract by a "fixed time" contract. Even though there may be instances where you do not use your time slice, in return for the occasional cost that you might incur for this you will have taken out big chunks of your MCT with correspondingly large overall benefits.

Example for Prototype Parts

You can also use time-slicing in a different way—not for a shared resource but rather for different classes of jobs; now the slices are based on the class of job. For instance, R&D departments often complain that they can't get prototypes made on time because hot jobs on the shop floor always get priority; these hot jobs are being shipped to paying customers and so the prototype job that is just for in-house use gets pushed aside. Let's say the prototypes need to go through a QRM Cell for various machining operations. You can time-slice the schedule for the whole cell, and assign some slices to R&D. For instance they could get the whole of the second-shift operation every Wednesday and Friday.

USE A COMBINATION OF STRATEGIES FOR MAXIMUM EFFECT

The ideas in this Appendix are not exclusive of each other; in many cases you can use two or more of them to get an even better solution. By changing the material, the design, and the process technology, you might find a smaller-scale process that can be done in the cell, and so on. This is where it really helps for the QRM Planning Team to include people from several different functional areas so there is a greater chance that this type of brainstorming exercise will be productive.

IF NO WORKABLE STRATEGY CAN BE FOUND, CONSIDER SPLITTING THE CELL IN TWO

Suppose a job requires five operations in a cell, then goes to a shared resource, and then needs four more operations in the cell. You could split the "before" and "after" operations into different cells. This is not an ideal solution, but it is still better than a cell whose flow is disrupted. At least each of these cells now has complete ownership of the flow within their cell. Also, you can use POLCA to manage the flow between the cells and the shared resource.

FOR FURTHER READING

Chapter 6 of *Quick Response Manufacturing: A Companywide Approach to Reducing Lead Times,* by R. Suri (Productivity Press, 1998), gives you more examples to help with brainstorming for cells. That chapter also contains more detailed instructions on how to decide the magnitude and frequency of time slices at a shared resource.