

Seradex White Paper

A Discussion of Issues in the Manufacturing OrderStream

Using Project Management Software for Production Scheduling

Frequently, we encounter organizations considering the use of project management software like Microsoft Project, Super Project or Timeline to schedule a manufacturing plant. We have been involved with many companies who have invested thousands of dollars and many valuable hours without success. Why does project management software fail in a manufacturing environment? Seradex has extensive experience in using both PM Software as well as finite scheduling products. They each have a place depending on your needs.

In the middle of the spectrum you have a little of both - for example building a large ship requires elements of both project management and production scheduling.

On the opposite end of the spectrum manufacturing toaster ovens requires production scheduling.

A production scheduler in a manufacturing company is not a project manager and is performing a much different function than a project manager.

Software Selection Spectrum

Production Scheduling

Project Management

Job Shop or Repetitive Mfg, Make to Stock, Make to Order	Design to Order	Unique projects
Autos, Consumer Electronics, Machine Shops, Printing, Chemical processing, Metal Stamping, Fabrication, Assembly	Large ships, defense contracts, aircraft, fashion products, automation machines	Build an Airport, Register for ISO 9000, Install computer network, R&D for new product, Launch sales campaign

A spectrum exists (see figure below) that includes project management on one end and production scheduling on the other. If you are building an airport or a road, launching a new sales campaign, preparing for ISO certification or implementing cross functional teams then project management is the tool for you. Project management software is designed, as the name suggests, for people who must manage projects. In the project management field a project with 300 resources and 1000 tasks is a small to mid size project.

Project management software is the wrong tool to use for a production scheduling. It is analogous to trying to catch fish with a mousetrap. Mousetraps work great to catch mice, but to catch fish, you need something else.

Likewise, computerized production scheduling software is the wrong tool to use for project management.

"If you are managing a project get project management software - if you are scheduling a factory get a tool like Seradex Xpress."

Project management

Project management software perspective is by and large "What resources do I need to complete this project?" This is not the question that manufacturing companies need the answer to. Production schedulers need to know "How can I best use my resources to complete all my work orders?" Project management software identifies which resources are over allocated. Seradex Xpress identifies what jobs are late.

Let's examine the vocabulary used in project management software and contrast this to the vocabulary used in production scheduling packages like SC 2000.

Project Management Software	Production Scheduling
Baseline vs. Actual	Standard. vs. Actual
Consolidate Projects	Production Schedule
Finish Date	Due Date
Over allocation	Bottleneck
Percentage complete	Percentage complete
Precedents	Required Operations
Project	Job/Work Order
Resource	Work Center
Task	Operations
Critical Path	N/A
Float	N/A
GANTT	N/A
Nodes	N/A
Outline	N/A
PERT	N/A
Relationships	N/A
Resource leveling	N/A
Subtasks	N/A
Task dependency	N/A
Task splitting	N/A
N/A	Routings
N/A	Material Lead

	Time
N/A	Scrap
N/A	Setup & Run Time
N/A	Tool Tracking
N/A	Bill of Materials

The vocabulary alone should help you identify which product is more suitable for your requirements.

There are four difficulties that arise in using PM Software for Production Scheduling:

- **Wrong Tool:** Trying to catch fish with a mousetrap
- **Productivity:** Hand saws vs. Chainsaws
- **Integration:** Scheduling, costing, inventory, estimating and entering data twice
- **Show Stoppers:** You can't get there from here

Wrong Tool: Trying to catch fish with a mousetrap

All PM software uses a concept called an "over allocated resource". In the factory, it is physically impossible to over allocate a resource - however - it is possible to have a late job! If you schedule 12 hours work into an 8 hour shift you do not have an over allocated resource you have a late job! It is conceptually incorrect to consider this as over allocating the resource. Production scheduling software is organized around the concept of how to ship on time.

Here are some other conceptual problems that create problems in using PM software for production scheduling:

- PM Software is oriented towards applications where you can rapidly scale resources up and down to

meet a finish date. You can call the union hall and get 200 more carpenters; you can rent equipment for short periods of time. Most manufacturing companies cannot scale their equipment or personnel so easily ("Yeah, Bob send me over a couple of 5 axis machines with operators for a week").

- Many users in a true project environment can have separate resource bases for each project or a limited subset of resources that apply over multiple projects. Most manufacturing companies use a common resource base to produce all products.
- Most PM Software allows the creation of "Project Templates" for repetitive projects. But, if you manufacture 700 different parts, you would require 700 templates - each a separate file.

Furthermore, templates do not include production quantities - only the total task time for each operation can be entered. The task times will vary are you producing one or fifty? Therefore every time you produce a part, you must adjust every task time for the quantity being produced.

- A significant aspect of using PM software is the extensive visual control. You can modify columns, bars, tables, profiles, timescales grids and colors; you can scale the visual output to print, formatting it for particular requirements, and so on. At a management overview level the visual output is very helpful for medium to long term planning.

However, is this information in the best format for efficient shop floor control? Supervisors and floor personnel need to know as quickly and simply as possible "What should I do next?" The best way to provide this is not through GANTT charts or work breakdown structures but through other measures like work orders and simple reports.

- In some PM Software it is difficult to compare actual to a standard (i.e. as you adjust a project, the original base line is not kept).
- To generate a master schedule, you are required to consolidate multiple projects together. The process of rolling many projects together is often manual and tedious. You must manually select each project file you want included. The ability to analyze and report on the consolidated results of multiple projects is usually weak or nonexistent. To properly control multiple projects a common resource data base and calendars are required and this is often lacking in PM software.
- Most PM Software allows task splitting. Moving carpenters from one house to another and back is very feasible in construction. Tearing down machines in the middle of a production run is not usually an economical practice.
- PM Software is set up to allow multiple parallel activities to be coordinated on a regular basis. For example, while constructing a house, electricians, plumbers, heating and ventilation and drywall contractors could be working simultaneously. Most manufacturing companies are more sequential than parallel. In manufacturing companies, you typically get something like design, fabricate, assemble, test and ship all occurring in series.
- The effectiveness of scheduling algorithms in PM Software varies widely. In the April, 1995 issue of Byte Magazine a test on the scheduling algorithms revealed significant differences.

Productivity: Hand saws vs. Chainsaws

- Implementing schedule changes in PM Software requires a great deal of manual editing. Priorities, forward/backward selections, task times, task completion and alternate resources must all be done at the task level. In SERADDEX XPRESS these activities can be done at the work order level or automated completely. The more cumbersome and time consuming schedule revisions become the less likely the scheduler can react in real time to solve problems.
- PM Software does have a priority system, but you must select the priority for each task in a project as opposed to globally setting a priority for each project. SC 2000, allows you to quickly adjust the priority of the entire work order. Customer demands, Murphy's Law and effective simulation all dictate frequent priority shifts on a work order by work order basis. To change a priority on a project in PM software requires that every task be manually adjusted. This is time consuming and unwieldy. In SC2000 priorities and forward/backward are set for the work order not for the individual tasks.
- Many manufacturing companies issue work orders for different quantities of items. This is not easily handled in PM Software. PM Software does not have a feature to calculate the total operation time using different quantities. Again each task must be manually edited to calculate the effect of different production quantities. If the quantity ordered changes, every task duration must be manually calculated and edited.
- Project Management Software ("PM Software") does not have facilities for set up and run times. You must manually calculate the total length

of time and apply this to a task each and every time you produce something.

- Updating the schedule from shop floor transactions again means calling up individual projects and working at the task level. No central data input form is available to update tasks across all projects. SC2000 allows transaction information from the shop floor, as well as routings and work order forms to be quickly entered or edited.
- PM software cannot automatically schedule a task from one resource to an alternate resource if the first is at capacity. So again this requires editing at the task level. SERADDEX XPRESS allows alternate resources to be maintained.
- PM Software does not allow alternate routings (i.e. you may have an automated machine and a manual machine. If the automated machine is tied up, automatically switch the operation to the manual machine.) This would require editing at the task level. SERADDEX XPRESS allows alternate routings to be maintained.
- Basic functions required by manufacturing companies like printing a work order or creating a routing database are not available in PM Software.
- User definable screens or forms for data entry or viewing can be easily created.
- In many PM Software programs the ability to rapidly adjust resource hours and availability and have a calendar view of the resource is not available

Integration: Scheduling, costing, inventory, estimating and entering data twice

- Most PM Software is not constructed on an open database making integration difficult.
- Most PM Software does not allow custom reports to be generated.
- In manufacturing, integration between estimating, invoicing, costing and scheduling, shop floor data collection and payroll is very beneficial. This eliminates entering the same data multiple times.
- Production scheduling requires shop floor data collection. This allows printing up to date status reports, identifies problems before they snowball and creates an archive of data that can help improve the accuracy of future schedules. The collection of this data by either bar code or shop floor time tickets is a key to the successful implementation of a scheduling system. Updating this information in many PM Software products can be a painful exercise; an exercise not designed for rapid data entry.
- Shop Floor data collection systems should update scheduling, costing, payroll and the quality systems. Ideally you only want to collect data once and feed it into other systems as required.
- Some PM Software products do allow for extensive programming, so you could modify some PM Software to accommodate the requirements of production scheduling.
- In SERADDEX XPRESS it is very simple to convert from an estimate to a schedule. Using PM Software, these are two separate processes.
- PM Software does not have facilities to track things like scrap or material lot numbers.
- (Or you could simply buy some production scheduling software

which has all these features already programmed in).

- PM software does not link to MRP functions like material planning and purchasing.

Show Stoppers: You can't get there from here

- PM Software does not offer multi-user capability (i.e. only one person can be in a project at one time.) This is a significant drawback in a manufacturing environment where you want multiple people to simultaneously enter work orders, routings, shop floor transactions, adjust priorities, and analyze the schedule.
- Some PM Software like Microsoft Project is limited to 80 projects (i.e. this would be equivalent to 80 work orders).

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The table below compares some common scheduling activities. John and Cathy are hypothetical production schedulers for a machine shop that supplies the aerospace industry. They currently have 10 jobs in house with an average 20 operations per job. They need to react to the following schedule events:

Event	PM Software - Cathy	SERADEX XPRESS- John
<p>Airco calls: an aircraft is grounded how fast can you make a ship the replacement parts required.</p>	<p>Cathy calls up a project template. She manually edits the 20 tasks to the highest priority and ASAP. 10 minutes</p> <p>She consolidates all outstanding projects. 3 minutes.</p> <p>She realizes that the CNC is over allocated. She puts in some overtime and generates the consolidated project. 3 minutes</p> <p>She prints out the newest GANTT chart - 5 minutes</p>	<p>John enters a WO for the part forward scheduled as priority 1 and regenerates the schedule - 2 minutes.</p> <p>He runs a late job report and finds two jobs are late. He realizes the rush job means the CNC machine must work 15 hours overtime to get all the other orders out on time. He points out the newest work order schedules. - 3 minutes.</p>
<p>The credit department calls and places one job on credit hold pending payment of a previous job.</p>	<p>Cathy reconsolidates the projects without the project on credit hold. She prints new GANTT charts - 10 minutes</p>	<p>John calls up the WO and selects credit hold. He regenerates schedule and prints the work order schedule - 2 min</p>
<p>Sales calls and wants to know when we can deliver 5,000 of part A101 for an important customer.</p>	<p>Cathy calls up a project template. The template is for a quantity of 1 so she has to manually calculate task times for each of the 20 tasks based on a volume of 5000. She guesses 5 weeks and reconsolidates all projects. She finds she has some over allocated resources. She adjusts two in house projects to a lower priority by editing the 20 tasks in each project</p>	<p>John enters a WO for 5,000 of A101. He regenerates the schedule and informs sales those can be delivered in 6.5 weeks.</p>
<p>Airco calls back - they found the parts on rush order in the warehouse. They still want the order but it is no longer a rush job.</p>	<p>She manually edits the 20 tasks to a lower priority and reconsolidates all projects. 10 minutes</p> <p>She prints out the newest GANTT chart - 5 minutes</p>	<p>John changes the priority of the work order from 1 to 5 and regenerates the schedule - 1 minute</p>
<p>The plant manager calls he wants to know all items (including set up and run times) that ran this year on the CNC lathe as they are evaluating a set up reduction program.</p>	<p>Cathy spends the rest of the day examining each project template and manually recording items that use the CNC lathe. She tells the plant manager that it would take too long to manually sort through all the job cards for the year to get set up and run times.</p>	<p>John performs an adhoc query and prints the report. - 3 minutes.</p>
<p>The controller wants a sales dollar shipment report (based on the latest schedule revisions)</p>	<p>Cathy must compile this information manually using finish dates from the PM Software and reviewing the pricing estimates - 25 minutes.</p>	<p>This is a standard report included in Seradex Xpress. John prints it - 30 seconds.</p>