Large scale, complex manufacturing has always been difficult and expensive to schedule, but Preactor has now proven a new simple and realistic solution. Brian Tinham reports

Complex supply chain scheduling made

There's more than one way to skin a cat – and more than one way to configure an effective advanced planning and scheduling (APS) environment. For manufacturers with larger-scale operations, maybe spanning several sites and even countries, recent work has shown that the best approach is what's termed 'heterarchical', meaning multi-level APS.

Dedicated local APS systems and people, managing their own areas, are loosely coupled over peer-to-peer data and communication links, but answer to a master planner with his or her own big-picture APS system.

Sounds complicated? In fact, it isn't. What's more it turns out to be very pragmatic. Most important, it works and it gets over the crazy alternative of attempting to develop huge multi-variable, multi-constraint planning models for an entire set of manufacturing processes with a lot of concurrent operations, some involving subcontractors, bought-in components and the rest – and all with dependencies.

Common sense

Certainly that's the experience at APS developer Preactor. Dr Nigel Shires, Preactor's application development manager, says the method grew out of work with pharmaceuticals giant Pfizer, which needed to plan and schedule drug production, co-ordinating facilities and lines both in the UK and North America.

"Centralised detailed scheduling for the various plants by head office wouldn't have worked," he says. "It would be too complex a problem, and the plans it generated would inevitably have ended up being rescheduled locally to meet local issues like machine availability and material yields." Equally, simply allowing each site to make its own scheduling decisions would have led to impossibly suboptimal supply chain operations, punishing inventory levels and unacceptable due-date performance.

Hence Preactor's heterarchical approach. And it doesn't just apply to the pharmaceutical sector. "We're now implementing this for three quite different clients," says Preactor technical director Graham Hackwell. "One is in commercial refrigeration, with a separate factory for each major stage of the process; the second is in aircraft seat manufacturing; and the third is in industrial heating and ventilating. This set-up would apply very well to the likes of British Aerospace and Rolls Royce – any company with a large scale assembly process having a lot of sub-processes, some internal, others external, that all need to be synchronised."

Shires explains: "So the solution at Pfizer and for these new customers is that you have a master planner with a rolled-up view, where each bar on the Gantt chart represents an assembly start and finish time in one of the areas in a factory. Information about each bar is transmitted to the appropriate factory area scheduler as the best window of opportunity for its processes.

"The master planner doesn't need to know more: it's up to the local scheduler to plan the detail – and he can respond to the master planner with a 'yes I can' or 'no I can't' message. That appears to the master planner as traffic lights on the screen Gantt bar: red received, green accepted, yellow, can't achieve the planner's window of opportunity."

Shires indicates that at this point some companies think they would like the master plan to be adjusted automatically by the local schedulers' outputs – but says that approach adds complexity and relegates master scheduling virtually to mere data collection. "No, in Pfizer when the master planner sees a yellow traffic light he picks up the phone and talks to the scheduler. That's a revolution – they talk on a peer-to-peer basis and discuss the issues, maybe material unavailability, and then decide together what to do. Then the master planer re-runs APS and re-publishes the slots to any local schedulers affected."

Hackwell explains that what's happening here is conventional but connected. "At a high level the requirement is to maximise OTIF [on-time, in-full] delivery performance and minimise WIP [work in progress] etc. So the master planner forward sequences to start with because some operations will already be close to the limit, and then sends the windows of opportunity to the local schedulers. If they can't meet that requirement they respond and communicate. Then the master planner backward sequences with the new information so

> **"This lends itself to a local lean revolution, but with overall control"**
>
> *Graham Hackwell, Preactor*

simple

that no-one is making or buying parts now that won't be used on the next operation in a sensible period."

Sounds good, so what are the implications? Well at Pfizer it meant a total of 50 Preactor APS licences – four masters and the rest for the distributed local schedulers. The IT infrastructure for the APS-to-APS connections was nothing special – just basic messaging rather like email but on Preactor's proprietary system.

That relatively simple technology architecture effectively breaks down scheduling into manageable, bite size chunks. And it gives people in complex manufacturing situations what they need – the software tools, the what-if simulation facilities, to take equal responsibility for meeting the overall business goals.

How big does the plant or planning problem need to be to go this route? Shires says it's not about size: it's more about recognising that if manufacturing is complex enough there are going to be conflicting rules and trade-offs. And he adds it's also about matching the solution to the way the organisation wants to work. So if the complexity, scale or geography mean it makes sense to keep local schedulers, this is the way to do it.

"You have to ask yourself how much a planner can cope with," he suggests. "If a planning screen is too jammed with bars it becomes meaningless. We've found that 2,000—5,000 live operations is the limit: APS at that level becomes a black box printing off work-to lists that no-one can understand... We've all met users who just press the forward sequence button and accept the results on the basis that it's got to be better than MRP because it's finite – but that's not good enough."

Why? Not least because running on blind belief doesn't give scope for continuous improvement. Shires: "With the heterarchical approach, over time planners can tighten up constraints and the windows of opportunity they give to local schedulers to improve supply chain performance, cut inventories and so on."

And Hackwell adds: "Effectively, you're honing your models so the schedules become increasingly accurate at every level, progressively squeezing out slack that you couldn't see before. It lends itself to a local lean revolution but with big picture control in what can be very difficult mixed-mode environments."

As for managing that continuous improvement, Shires says the best system reports are those covering OTIF and 'average link length'. "That's the amount of time between the end of production of one of the assemblies and the start of the next that consumes them," he explains. "Those two give management a good understanding of how well they're doing and good pointers to focus improvement work."

The final word goes to Hackwell: "A lot of lean consultants smile when we explain this approach," he says. "Going heterarchical divides the problem up but still gives control. It's the best of both worlds: slick, fast local scheduling but fitting into a grand plan. It's using IT in a way that makes a real difference to very complex problems yet keeps the door wide open for realistic, achievable and understandable improvement." ■

Graham Hackwell and Nigel Shires of Preactor: "Going heterarchical divides the problem up but still gives overall control."

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Preactor International
Cornbrash Park, Bumpers Way,
Chippenham, Wilts SN14 6RA
Tel: 01249 650316
Email: sales@preactor.com
web: www.preactor.com