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How Important are Schedules and Time Compression?

Modeling Techniques for Real-Life Projects

Have you ever driven along a highway where a construction project seemed to be going on for ever? You drive for miles and miles, past thousands of orange barrels and cones, past hundreds of barriers and signs, past dozens of expensive cranes, bulldozers, backhoes and such, and miles of temporary concrete dividers. Yet there are hardly any people in sight. Where are the workers? Why is there ten miles of detoured traffic and only 10 yards of active work?

Not only that, but you drove by that spot six months ago and hardly anything has changed.

Getting beyond your immediate frustration with the traffic slowdowns, your ever inquisitive mind drifts to the topic of waste. How much money is tied up in all of this paraphernalia? How much money could be saved by expediting these projects (as well as reducing the inconvenience to the driving public).

Period Costs & Hammocks

The typical project will contain a combination of labor-based costs, materials costs, and other costs such as equipment rentals and supplies. Consider that many of these are period-based costs. That is, the costs are associated with the duration of the use, rather than the intensity or frequency of use.

If we look at the highway type projects, such as discussed above, we can list several period-based costs. These would include field trailers, office equipment including computers and phones, earth moving equipment, and such. What about all of those orange barrels and cones? They must represent a reasonably sized capital investment. What about Foremen? The longer the job, the longer the cost.

Good scheduling software, such as Scitor's PS7, has a "hammock" function. A Hammock is a type of task that does not have a fixed time duration. Instead, it automatically calculates its duration from the tasks that it is associated with (or group of tasks that the hammock spans).

You can use the hammock function for all tasks that have resources or costs that are associated with time periods that are dependent on other tasks. For instance, let's say that we rent a backhoe, at $200 per day. We create a "hammock" task, called "Rent Backhoe", and assign a cost of $200 per day. We note a start-to-start relationship with the first task that requires the backhoe, and a finish-to-finish relationship with the last task that requires the backhoe. That's it. If the string of tasks using the backhoe stretches out for 21 days, then the rental cost is automatically calculated as $4200. If the schedule is

compressed to reduce that span to 16 days, then the backhoe cost is automatically recalculated to $3200.

By setting up these period cost tasks, using hammocks, you can easily see the effect of squeezing time out of the schedule. Often, the additional costs of overtime and/or night work can be offset by the reduction in period costs. Maybe not all of the time, but, with this method, you don't have to guess about it. Also, using the hammocks this way, you can also be aware of the true cost of delays. By the way, Microsoft Project 98 does not support hammocks.

Time-to-Market

Here's another thought to ponder. We all read continually about the importance of "time-to-market". We hear of constant advances in shortening product development cycles. We know that there are competitive inducements to compressing the time-to-market. And we can postulate that shortening the process might even reduce the cost of development.

But how much has been written that actually quantifies the benefits of shorter development cycles? Well Geoffrey Moore [Crossing the Chasm (1991) and Inside the Tornado (1995)] has some interesting figures to offer on this.

He says; when a new product is created for a new market, the first one getting to market is most likely to garner at least 50% of the total market. The remaining 50% is all that will remain for all of the other players. No wonder that there is so much pressure on new developments (and, perhaps why some developers are willing to skimp on quality rather than chance delays).

Hey! There's more yet. If the first vendor to the market garners 50% of possible sales, while #2 picks up, say, 20%, that is not the probable ratio for income. That is because #1 sets the price, which, without competition allows maximizing profits and return on investment. By the time that the other vendors join the battle, profit margins will drop (but only after #1 has made its killing). Moore figures that #1 will garner at least 70% of the profits pie, in this model.

Now I ask you -- is that enough motivation to drive schedule compression and management?

Every day that can be squeezed out of the schedule improves the developer's chances of grabbing the lion's share of the market. The new product developer must not only invest effort in creating fast-track schedules. That developer must continually tweak the schedule looking for ways to optimize (shorten) the time cycles. The payoff, for getting there first, is monumental.

Extended Cash Flow Projections

We typically engage critical path scheduling software to plan and control a project. We normally will define the project as all that takes place from the project authorization or

initiation through to the completion of all deliverables. If we use the costing capabilities of the software, it is applied across this time period, generally encompassing all costs incurred to complete the deliverables.

But why stop here? Cash flow can be positive as well as negative. If the project that we are managing is intended to generate a positive cash flow (such as the new product developments discussed above), why not add pseudo tasks that generate income. Now we can model various scenarios and evaluate the best actions for a project. We can go beyond determining the most cost effective plan to complete the project, but rather the best plan to generate the preferred long term cash flow.

Carrying this process even further, we can evaluate a set of projects and manipulate the mix of projects to optimize support of the full business strategies and plans. We hear a lot lately about Project Portfolio Management. A significant component of this corporate-level strategy is the schedule-based cash flow analysis of multiple projects.

Risk Considerations

Up to now, we have talked about schedules as if they were based on well defined task durations. But we all know that this is an illusion. Task durations are based on time estimates and effort estimates. These are always based on one or more assumptions, and these assumptions are subject to interpretation. What tends to happen is that all such estimates are developed with some built-in contingency. Yes, we do run into instances where an optimistic individual offers a "best chance" estimate. But most estimates assume that one or more conditions will exist to stretch a task past its achievable duration. So a ten-day task gets 2 days added for possible weather delays, another 2 days for resource conflicts, one more day for equipment problems, and perhaps another 3 days just for comfort. Now, with the 10-day task up to 18 days, we add a couple of days because we know that the project manager will ask for a ten percent improvement, to expedite the schedule.

There are many ways to address this dilemma, such as using multiple estimates (PERT Durations) or shared contingency concepts such as Critical Chain and Project Contingency Allowance techniques. These will be discussed in a later article. However, there is one aspect of this condition of which we all must remain aware. There is a relationship between schedule contingency and schedule risk. The insertion of contingency in schedules is motivated by the urge to reduce risk of failure. Although adding contingency does not necessarily reduce such risk (because we learn to use the contingency to let things slip), it does provide more room for error and corrective action than we would have in a very tight schedule.

If we are to use contingency (which I highly advise) then this must be a "managed contingency". By a managed contingency I mean the following:

- We must know the basis for the contingency. That is, if we allow 2 days for weather and 1 day for equipment, this should be noted.
- The contingency should be separated from the real expected duration.
- Pressure should be maintained on achieving the "most likely" times.
- Time is shifted from the contingency pool to the schedule by the manager, who will maintain an analysis of schedule performance and contingency use.

The tighter the schedule, the less room there is for things to go wrong (there is less time available for corrective action, therefore limiting remedies). This increases the importance of proactive risk management. Management must be fully aware of all areas of risk. These risk areas must be under constant surveillance. The risk adverse manager is prepared in advance to take remedial action, by having alternate plans ready for action if needed.

PERT Analysis

There is a tool available to aid in the analysis of schedules having varying degrees of time contingency. It involves using three time estimates for each task. You will find this feature in PS7 under the heading of PERT Analysis.

The method consists of assigning an optimistic, most likely, and pessimistic estimate to each task. For instance, a task might have a most probable duration of 4 days, with a best case execution in three days. However, it may also be prone to delays, bringing the pessimistic estimate to ten days. We enter this as 3,4,10. We can also set weights to each of the three categories. If we want to factor in a bit of extra contingency, we could weigh the pessimistic values a bit heavier than the optimistic ones. Calculation of the schedule, based on these weighted estimates, is automatic.

We gain at least two advantages from this method. First, by defining three estimates, we have a better feel of the true time estimate and the range of risk and contingency for each task. For instance, a task with a 3,4,10 estimate would be more risk prone than a task with a 5,5,5 estimate.

Second, we can calculate the schedule using various weights. This will let us see projected project completion dates for various degrees of optimism or contingency. It doesn't change how long the project takes. But it does provide insight into the possible outcomes. This is information that management needs to make intelligent decisions.

The Value of Critical Path Scheduling

CPM has been around for over forty years, and has been employed with varying degrees of success. Although subject to criticism at times, for being too difficult to use or understand, it is almost universally employed by serious project managers on serious projects. For most situations, it does the job. It is the basis for the techniques that have

been described above: the use of hammocks, project portfolio analysis, and PERT analysis. It is also the basis for other scheduling techniques.

If we operate in a project environment where shortening project duration has a big payoff, these techniques will provide assistance in achieving shorter times and evaluating scheduling options.

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