Project Life Cycles and the WBS
Part One: Typical Project Life Cycles

If you have studied the basics of project planning, you surely have learned about Work Breakdown Structures. If, for some reason, you have overlooked this important subject, we invite you to read two previously published papers in this section of the Scitor website. For starters, checkout **"Techniques for Project Initiation – Part Four"**. For further discussion, you'll want to read: **"Do You Weebis? Clarifying WBS, OBS and RBS"**.

In our discussion of techniques for getting started, we note the need to establish structures to facilitate the building of the plan and schedule. These include Work Breakdown Structures, Organizational Breakdown Structures, Budgeting Structures, and Project Milestone Schedules. The use of WBS type hierarchical structures does more than just facilitate the development of the plan. It also provides a basis for sorting, selecting (filtering) and summarizing all of the project data.

The concept of WBS's is about as simple as it gets. Yet, we tend to struggle a bit in implementing the concept. I can attribute this to the fact that there is rarely a single right or wrong WBS for any project. Any WBS can be structured differently for any project, and still be "correct". Furthermore, there can be several, concurrent WBS's for any project, all of which could be used effectively for a basis for sorting, selecting and summarizing all of the project data. We won't go into this here, because it is discussed in the referenced papers.

However, while we're talking about structures, we should discuss Project Life Cycles. Certainly, the project life cycle is a primary project structure. We can use the project life cycle as one of our work breakdown structures – essentially a phase-oriented WBS.

There is a tendency to look at the project life cycle as a standard cycle for all projects. But, this is clearly wrong. Within each industry and application area, there is at least one project life cycle that is tailored to the nature of the work in that area. Recognizing and using the project life cycle structure is important to identifying and organizing the work associated with the project.

Some Typical Project Life Cycle Models

The phases of a project – the project life cycle – can take many shapes. To illustrate this, we need only to look some of the work done by the Project Management Institute (PMI). Several members of PMI have contributed to the development of standards and guidelines as part of the Project Management Body of Knowledge (PMBOK®). Below are a few "typical" life cycles, as presented in *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*.

For Defense Acquisition:

Determination of Mission Needs (ends with Concept Studies Approved)

Concept Exploration and Definition (ends with Concept Demonstration Approval)

Demonstration and Validation (ends with Development Approval)

Engineering and Manufacturing Development (ends with Production Approval)

Production and Deployment (overlaps with Operations and Support)

Operations and Support

For Construction:

Feasibility

Planning and Design

Production

Turnover and Start-up

For Pharmaceuticals:

Discovery and Screening

Preclinical Development

Registration Workup

Postsubmission Activity

For Software Development: (A spiral model of four cycles with four phases in each)

Proof of concept cycle

First build cycle

Second build cycle

Final build cycle

Each cycle has four components: Identify, Design, Construct, and Evaluate

Certainly, anyone who has worked within these application areas can recognize the applicability of these project life cycles to some of the projects in these areas, while justifying modifications to these project life cycles for other the projects. Without arguing the exact correctness of any of the above project life cycle illustrations, we can submit that it is valuable to identify an appropriate project life cycle for any project and to use that structure as one of the bases for developing the plan.

Where Do Proposals Fit In?

A problem that has always bothered me is how the proposal phase fits in (if there is one). When there is a proposal phase, some planning and budgeting (and risk assessment, etc.) is performed at that phase and then again at inception. When a proposal is not involved, these activities take place during the earliest phases. The problem here again is that it's difficult to define a one-size-fits-all approach.

Nevertheless, this situation serves to point out another characteristic of work breakdown structures. It is perfectly reasonable to have a set of activities to occur in more than one stage of the project, or in more than one location within the WBS. Risk assessment, for example should have multiple appearances, depending on the type of structure. In a functional structure, it would occur only once within the hierarchy, with possible multiple items as branches, denoting the risk assessment in each applicable area. However, in phased-type WBS, such as the Project Life Cycle, the risk assessment would appear in each applicable stage of the life cycle, starting with the proposal phase.

Using Project Life Cycles

If the project life cycle is a phase-oriented view of the project, then it stands to reason that we can and should use the project life cycle as one of the mechanisms to monitor the project progress against the project goals. Often, but not always, there is a definable set of deliverables associated with each phase. We should pause to review the project accomplishments, as each phase comes to completion. This is one of the times during the project where we look at the objectives and evaluate performance to date against these objectives. If the objectives are not being supported, should the strategy be changed? Should the project be terminated? Should the objectives be re-examined? If the project moves ahead, should new targets be examined and communicated? Should the stakeholders have an opportunity to re-evaluate their positions and to influence how the job goes forward?

This concept of phase-oriented progress review is gaining popularity, under the name of "phase-gate" or "stage-gate". The end of a phase is treated as a gate. The project does not pass through the gate unless it is reviewed and progress is determined to be consistent with objectives.

By the way, when reviewing the project progress, it is not enough to look for consistency with the project objectives. We need to look for harmony with the overall business objectives and the mission of the enterprise. A successful project that does not support the larger mission of the firm is like winning the battle but losing the war.

The Phase-Deliverables Model

Another use of the project life cycle is as a basis for standard work breakdown structures. All projects having a similar project life cycle can have a default WBS, by phase. This can be used as a starting point for the development of the project workscope definition and the project plan.

Two of the most popular models for WBS are the phase model and the deliverables model. Perhaps the best is to combine the two. Develop the phase-based model, based on the project life cycle. Then add the next level, based on the deliverables within each phase. This allows you to have a standard WBS down to the phase level and then to modify the next level according to the specific deliverables for that project.

The phase-based WBS is a WBS that is time oriented. The default approach is to start with the assumption that each phase will be completed before the next phase starts. Normally there will be exceptions to this rule. There will be work on items that will start before a preceding phase is completed. This is done with the knowledge of and acceptance of a measured risk.

There will be times where the phase-by-phase timing of a project will extend the project completion date beyond an acceptable time. In these cases, the project team will look for opportunities to overlap or "fast-track" the work. In another earlier paper "Techniques for Project Initiation-Part Five", we illustrated a Project Milestone Schedule for a turnkey power plant. If you look at the Figure, you will note that the first level of the schedule is based on project phases, and that these phases have been overlapped to reduce the overall project duration to 24 months. The first cut of this schedule, without overlapping, produced a project duration of 36 months.

Avoiding Common Errors

A frequent mistake by novice project managers is to assume that the WBS has to be time oriented. This is not a requirement. In fact, it is preferable to ignore the element of time when developing a WBS that is based on deliverables, organization structure, cost accounts, locations, etc. The exception is the WBS that is based on the project life cycle. This one is time oriented – at least at the phase level.

However, as a guide (with the above-noted exception), avoid developing a WBS that looks at items as they occur chronologically. That's what the critical path network is for.

A Generic Project Life Cycle

Earlier in this paper, we provided some examples of typical project life cycles for several types of applications. In part two of this series on Project Life Cycles, we will provide a model for a generic PLC.

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