Scheduling Resources

The most important resources that project managers have to plan and manage on day-to-day basis are people, machines, materials, and working capital. Obviously, if these resources are available in abundance then the project could be accelerated to achieve shorter project duration. On the other hand, if these resources are severely limited, then the result more likely will be a delay in the project completion time. Depending on the type of resources, the costs of providing an abundance of such resources to accelerate project completion time can be very high. However, if resources are readily available, then project cost should be low, as some project costs are resource related while others are likely to be time dependent. In general, projects with a shorter duration are less expensive. The longer the duration of the project, the higher will be overall project cost due to the increase in fixed costs such as overheads. The reality is that as long as the work on a project is ongoing it will continue to draw resources into its orbit.

Resources Definition

The first step in resource modeling is to decide exactly what resources are considered important enough to be modeled. Resources definition is the identifying of critical resources which are required for successful completion of project. While most resource modeling is concerned with people or workers (such as masons or computer programmers), it may also include other resources such as machines (such as a computer of a particular specification or a concrete mixer), or space on a project where space is restricted and where this restriction limits the amount of other resources which can be deployed at any one time. Often resources are specified in terms of the number of units of resource required, e.g., 5 masons or 3 computer programmers. Alternatively, resources may be specified in terms of the hours or days that a specific resource is required, e.g., 40 mason hours or 24 computer programmer days. Resources may be considered as consumable, such as materials that may be used once and once only, or non-consumable, such as people, which may be used again and again. The way in which consumable resources are used is not critical as long as they are used efficiently. However, the way in which non-consumable resources are used can have a significant impact on the project. For example, there is a significant difference between requiring 16 units of a non-consumable resource for one week, thus requiring 16 units to be made available at that time, and requiring 1 non-consumable unit for 16 weeks, thus only requiring 1 unit which can be reused 16 times.

Resource Allocation

Resource allocation, also called resource loading, is concerned with assigning the required number of those resources identified in the previous step to each activity identified in the plan. More than one type of resource may be attributed to a specific activity. For example, fixing the plates on a ship's hull may require 10 fitters, 20 welders, 15 laborers and a certain type of welding machine. From a practical standpoint, resource allocation does not have to follow a constant pattern; some activities may initially require fewer resources but may require more of the same resources during the later stages of the project.

Resource Aggregation

Resource aggregation involves determining the aggregate resources that will be needed, period by period, to complete all project activities.

Resource Leveling

Having identified the necessary resource requirements, the last stage in the process is *resource leveling*. In this stage, we attempt to ensure that the demand for resources does not exceed availability. Specifically, demand for resources is smoothed to ensure that the peaks and valleys are reduced.

Manpower Scheduling

Manpower scheduling is the process by which the daily manpower level for each craft or skill is selected to complete the work in the most efficient (orderly, economical, safe) manner.

The most important consideration is the work to be performed, with all of the logistical and safety aspects playing an important role.

Manpower should be scheduled so as to avoid interruptions of productive time, repeated staffing up and de-staffing (hiring/firing of workers), repeated movement of workers from one end of the unit/plant to the other, creating a work logjam or peak demands for equipment (such as cranes, trucks, etc.) or loading the work area with more men than it can adequately and/or safely hold (workspace density saturation).

Evaluating the workspace density saturation can be done by calculating the total work area and dividing it by the number of workers inside that area. This total area must include not only the ground level area, but platforms, elevated walkways, etc.

Also, certain operations require a greater area or room than others: equipment removal/installation, major repairs, large scale demolition, etc.

The best efficiency can be accomplished when the scheduled work exceeds the available manpower by at least fifteen (15%) percent. This means that every shift, all supervisors should have on their schedules at least 15% more work listed than they can physically achieve with their crews. The reason for this is that in the event that some of the listed (scheduled) work cannot be performed for whatever reason (tools, equipment, materials, safety, weather, etc.) then there is always other work available. This will prevent interruptions or delays in the utilization of manpower, and therefore it will help achieve a high level of productivity.

Delivering Materials

The arrival of material at the job site should never be a surprise; the exact time of a delivery should be established in advance. Unexpected deliveries are a disruption to work at the site, and often the only person available at the time to accept the delivery is unqualified for the job. At the job site, a specific worker should be assigned to accept the delivery and to oversee unloading. This person needs to have a copy of the purchase order in hand when the material arrives. Unloading equipment should be available and a specific place assigned for storage. As the shipment is unloaded, it should be inspected for completeness and for damage. Any deviations from the purchase order need to be noted on the delivery ticket, and that information must be passed on to project management.

When warehousing is required, an inventory control system has to be established. Care must be taken that materials and equipment are issued to the specific installation for which they were ordered. Exceptions need to be approved and documented so that one construction operation does not use materials ordered and needed by another operation.

Whenever possible, the material or equipment should be moved directly from the carrier to the final installed location. If this is impossible or impractical, the material should be stored in a location that will minimize handling and handwork. It is estimated that handling, moving, and handwork account for as much as 30 percent of the cost of installation. With inadequate planning, material orders are too often incomplete or damaged and the problem is not noted until the day of installation. If proper arrangements are not made, waterproof materials may be stored in buildings while weather-sensitive materials wind up in the rain, or it is determined too late that a trench must go directly through the place where topsoil is stockpiled. Detailed planning regarding material handling and storage saves money and prevents unnecessary and frustrating delays.

At times, materials must be stored off-site. In this case, issues of title, insurance, and payment are involved. It must be determined when title changes from the supplier to the contractor and from the contractor to the owner. Whoever has title also has insurance responsibilities, and these must be coordinated. It must also be determined when payment will be due, first from the contractor to the vendor and then from the owner to the contractor.

Project Control During Execution

The **Project Execution Phase** is the third phase in the *project life cycle*. In this phase, you will build the physical project deliverables and present them to your customer for signoff. The *Project Execution Phase* is usually the longest phase in the project life cycle and it typically consumes the most energy and the most resources.

To enable you to monitor and control the project during this phase, you will need to implement a range of management processes. These processes help you to manage time, cost, quality, change, risks and issues. They also help you to manage procurement, customer acceptance and communications.

1. Perform Time Management
   Project Time Management is all about recording the time spent by people on a project. The best way to see if your project is on track is to record time actually spent vs. time planned to be spent.
2. Perform Cost Management
   A Cost Management process helps you control expenses within an organization.
3. Quality Management

A Quality Management Process is critical process within any business, as it helps you to ensure that the deliverables produced, actually meet the requirements of your customer. A Quality Management Process is a set of procedures that are followed to ensure that the deliverables produced by a team are "fit for purpose". The start of the Quality Management Process involves setting quality targets, which are agreed with the customer. A "Quality Assurance Process" and "Quality Control Process" are then undertaken, to measure and report the actual quality of deliverables.

4. Change Management

   Record change request, review them and approve them before implementing any change. It is not about preventing change but rather managing change which is inevitable.

5. Risk Management

   a risk is defined as any future event that may prevent you to meet your team goals. A Risk Process allows you to identify each risk, quantify the impact and take action now to prevent it from occurring and reduce the impact should it eventuate. Most teams are subject to constant risk of meeting their objectives. The key to success lies in how you manage risks, by putting in place a clear *Risk Management Process*. This process describes the steps taken to mitigate risk as it occurs, helping you to meet your team goals more easily.

6. Issues Management

   Issues Management is the process of identifying and resolving issues in a project or organization. Your ability to identify and resolve issues as quickly as possible will directly affect the success of your team.

7. Procurement Management

   Procuring goods and services from external suppliers can be a critical path for many projects. Often, the performance of the supplier will reflect on the performance of the overall project team. It's therefore crucial that you manage your suppliers performance carefully, to ensure that they produce deliverables which meet your expectations.

8. Communication Management

   Keeping your stakeholders regularly informed is a critical activity for any team. Whether it's through status reports, regular meetings or informal email, you can ensure that the right messages are distributed about the progress of your project. This will help your project team and external stakeholders to remain focused on delivery and to provide you with all of the support you need to deliver your project successfully.