13.2 BAR (GANTT) CHART

PMBOK® Guide, 4th Edition
6.6.2.3 Schedule Comparison
Bar Charts

The most common type of display is the bar or Gantt chart, named for Henry Gantt, who first utilized this procedure in the early 1900s. The bar chart is a means of displaying simple activities or events plotted against time or dollars. An activity represents the amount of work required to proceed from one point in time to another. Events are described as either the starting or ending point for either one or several activities.

Bar charts are most commonly used for exhibiting program progress or defining specific work required to accomplish an objective. Bar charts often include such items as listings of activities, activity duration, schedule dates, and progress-to-date. Figure 13–1 shows nine activities required to start up a production line for a new product. Each bar in the figure represents a single activity. Figure 13–1 is a typical bar chart that would be developed by the program office at program inception.

Bar charts are advantageous in that they are simple to understand and easy to change. They are the simplest and least complex means of portraying progress (or the lack of it) and can easily be expanded to identify specific elements that may be either behind or ahead of schedule.

Bar charts provide only a vague description of how the entire program or project reacts as a system, and have three major limitations. First, bar charts do not show the interdependencies of the activities, and therefore do not represent a "network" of activities. This relationship between activities is crucial for controlling program costs. Without this relationship, bar charts have little predictive value. For example, does the long-lead procurement activity in Figure 13–1 require that the contract be signed before

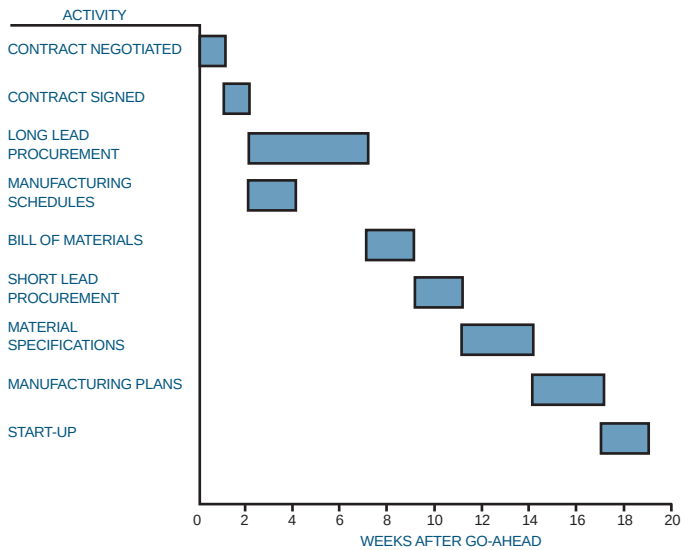

FIGURE 13–1. Bar chart for single activities.

procurement can begin? Can the manufacturing plans be written without the material specifications activity being completed? The second major discrepancy is that the bar chart cannot show the results of either an early or a late start in activities. How will a slippage of the manufacturing schedules activity in Figure 13–1 affect the completion date of the program? Can the manufacturing schedules activity begin two weeks later than shown and still serve as an input to the bill of materials activity? What will be the result of a crash program to complete activities in sixteen weeks after go-ahead instead of the originally planned nineteen weeks? Bar charts do not reflect true project status because elements behind schedule do not mean that the program or project is behind schedule. The third limitation is that the bar chart does not show the uncertainty involved in performing the activity and, therefore, does not readily admit itself to sensitivity analysis. For instance, what is the shortest time that an activity might take? What is the longest time? What is the average or expected time to activity completion?

Even with these limitations, bar charts do, in fact, serve as useful tools for program analysis. Some of the limitations of bar charts can be overcome by combining single activities, as shown in Figure 13–2. The weakness in this method is that the numbers representing each of the activities do not indicate whether this is the beginning or the end of the activity. Therefore, the numbers should represent events rather than activities, together with proper identification. As before, no distinction is made as to whether event 2 must be completed prior to the start of event 3 or event 4. The chart also fails to define clearly the relationship between the multiple activities on a single bar. For example, must event 3 be completed prior to event 5? Often, combined activity bar charts can be converted to milestone bar charts by placing small triangles at strategic locations in the bars to indicate completion of certain milestones within each activity or grouping of activities, as shown in Figure 13–3. The exact definition of a milestone differs from company to company, but usually implies some point where major activity either begins or ends, or cost data become critical.

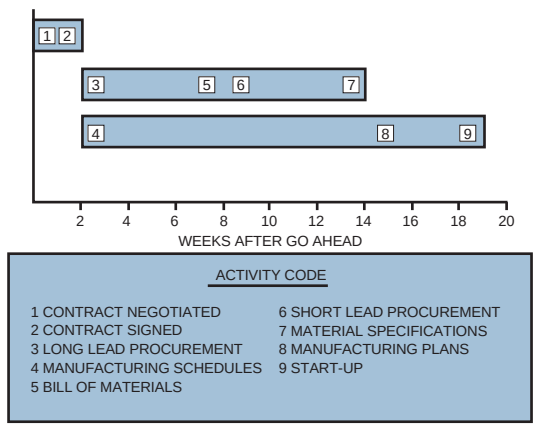

FIGURE 13–2. Bar chart for combined activities.

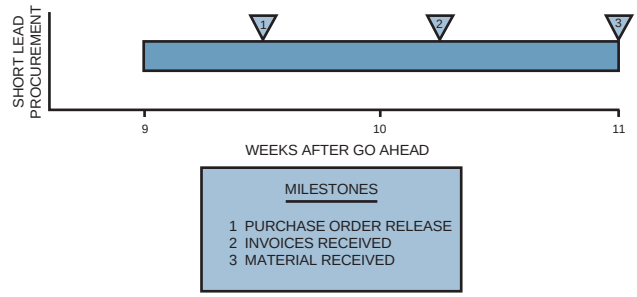

FIGURE 13–3. Bar/milestone chart.

Bar charts can be converted to partial interrelationship charts by indicating (with arrows) the order in which activities must be performed. Figure 13–4 represents the partial interrelationship of the activities in Figures 13–1 and 13–2. A full interrelationship schedule is included under the discussion of PERT networks in Chapter 12.

The most common method of presenting data to both in-house management and the customer is through the use of bar charts. Care must be taken not to make the figures overly complex so that more than one interpretation can exist. A great deal of information and color can be included in bar charts. Figure 13–5 shows a grouped bar chart for comparison of three projects performed during different years. When using different shading techniques, each area must be easily definable and no major contrast should exist between shaded areas, except for possibly the current project. When grouped bars appear on one chart, nonshaded bars should be avoided. Each bar should have some sort of shading, whether it be cross-hatched or color-coded.

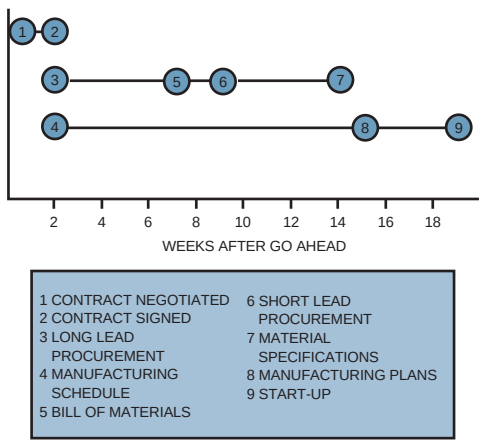

FIGURE 13–4. Partial interrelationship chart.

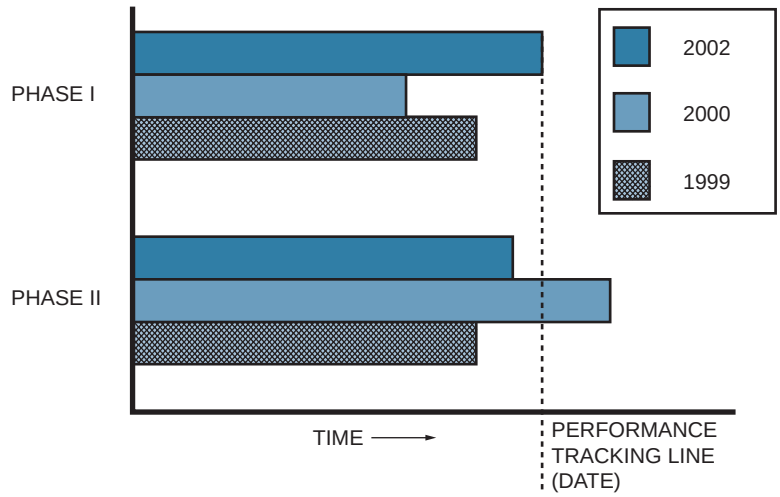

FIGURE 13–5. Grouped bar chart for performance comparison.

Contrasting shaded to nonshaded areas is normally used for comparing projected progress to actual progress, as shown in Figure 13–6. The tracking date line indicates the time when the cost data/performance data were analyzed. Project 1 is behind schedule, project 2 is ahead of schedule, and project 3 is on target. Unfortunately, the upper portion of Figure 13–6 does not indicate the costs attributed to the status of the three projects.

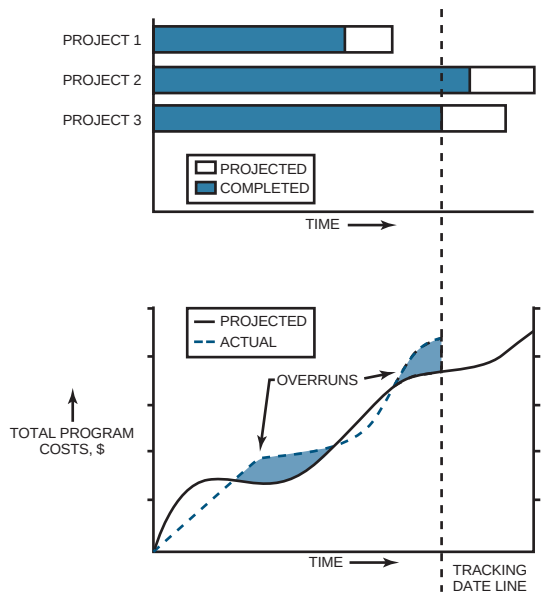

FIGURE 13–6. Cost and performance tracking schedule.

By plotting the total program costs against the same time axis (as shown in Figure 13–6), a comparison between cost and performance can be made. From the upper section of Figure 13–6 it is impossible to tell the current program cost position. From the lower section, however, it becomes evident that the program is heading for a cost overrun, possibly due to project 1. It is generally acceptable to have the same shading technique represent different situations, provided that clear separation between the shaded regions appears, as in Figure 13–6.

Another common means for comparing activities or projects is through the use of step arrangement bar charts. Figure 13–7 shows a step arrangement bar chart for a cost percentage breakdown of the five projects included within a program. Figure 13–7 can also be used for tracking, by shading certain portions of the steps that identify each project. This is not normally done, however, since this type of step arrangement tends to indicate that each step must be completed before the next step can begin.

Bar charts need not be represented horizontally. Figure 13–8 indicates the comparison between the 2000 and 2002 costs for the total program and raw materials. Three-dimensional vertical bar charts are often beautiful to behold. Figure 13–9 shows a typical three-dimensional bar chart for direct and indirect labor and material cost breakdowns.

Bar charts can be made colorful and appealing by combining them with other graphic techniques. Figure 13–10 shows a quantitative-pictorial bar chart for the distribution of total program costs. Figure 13–11 shows the same cost distribution as in Figure 13–10, but represented with the commonly used pie technique. Figure 13–12 illustrates how two quantitative bar charts can be used side by side to create a quick comparison. The right-hand side shows the labor hour percentages. Figure 13–12 works best if the scale of each axis is the same; otherwise the comparisons may appear distorted when, in fact, they are not.

The figures shown in this section do not, by any means, represent the only methods of presenting data in bar chart format. Several other methods are shown in the sections that follow.

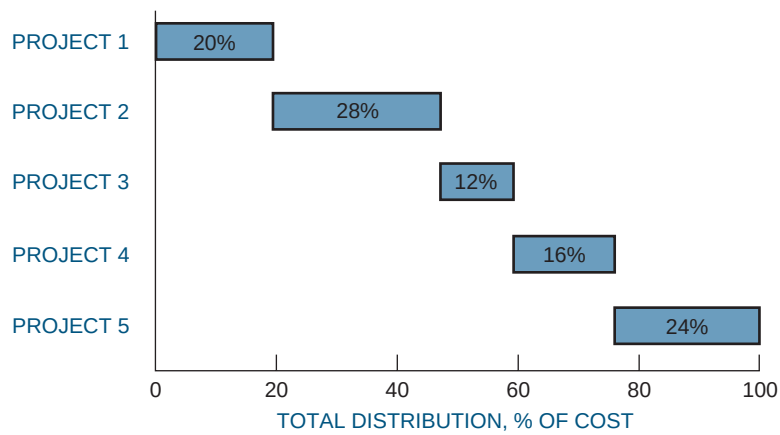

FIGURE 13–7. Step arrangement bar chart for total cost as a percentage of the five program projects.

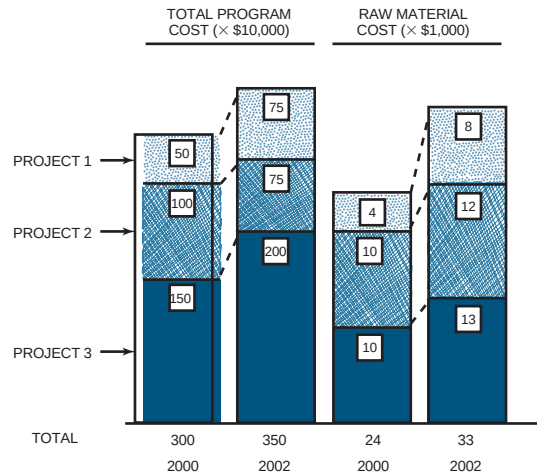

FIGURE 13–8. Cost comparison, 2000 versus 2002.

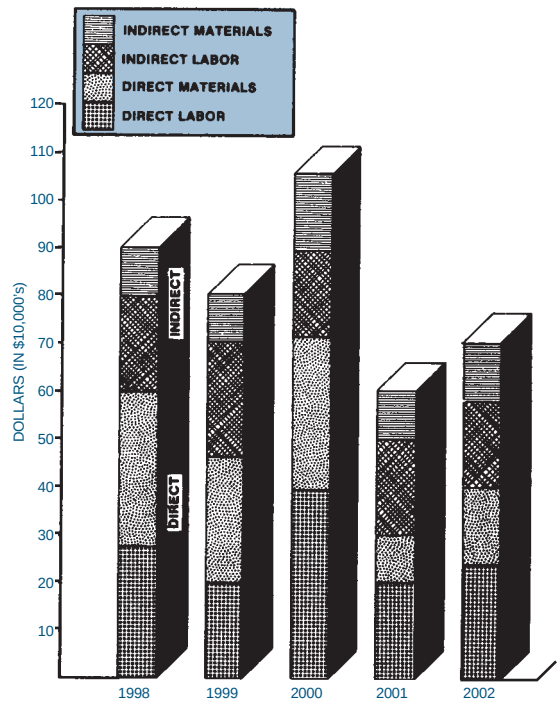

FIGURE 13–9. Direct and indirect material and labor cost breakdowns for all programs per year.

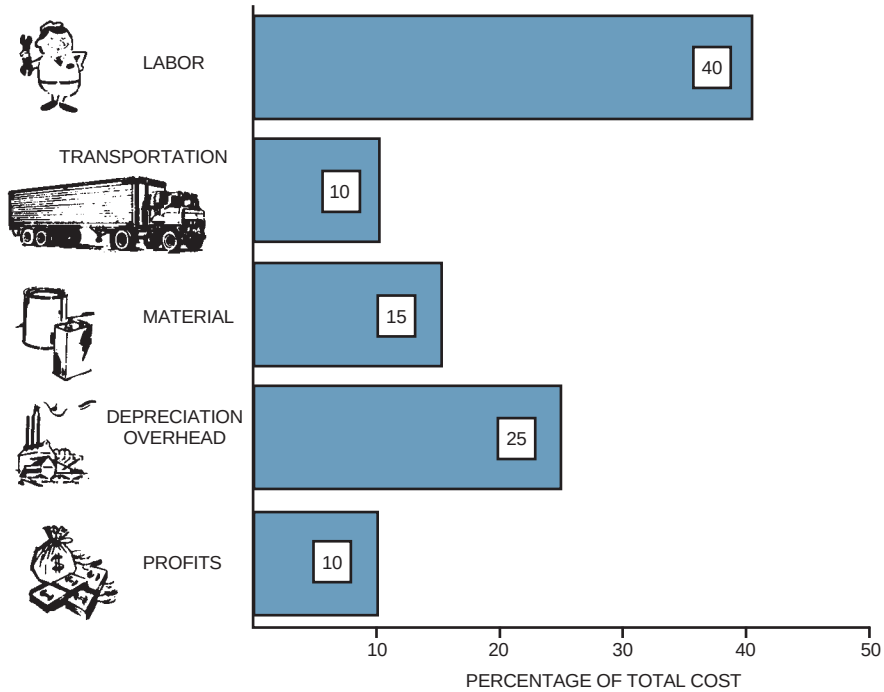

FIGURE 13–10. Total program cost distribution (quantitative-pictorial bar chart).

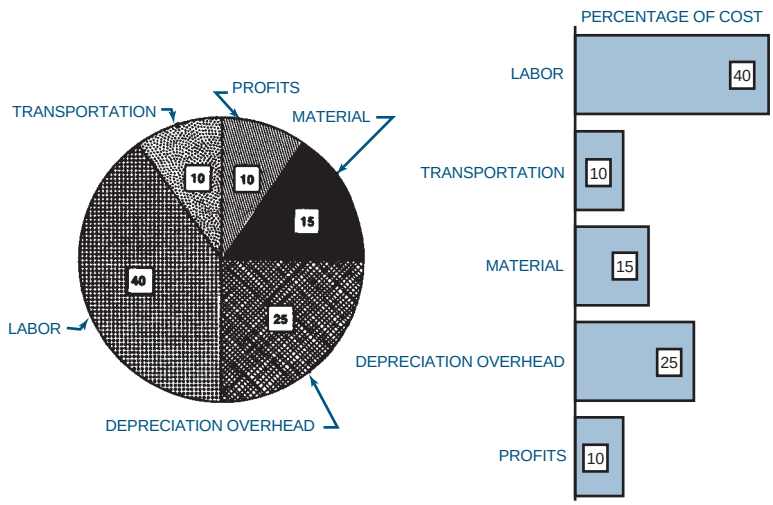

FIGURE 13–11. Distribution of the program dollar.

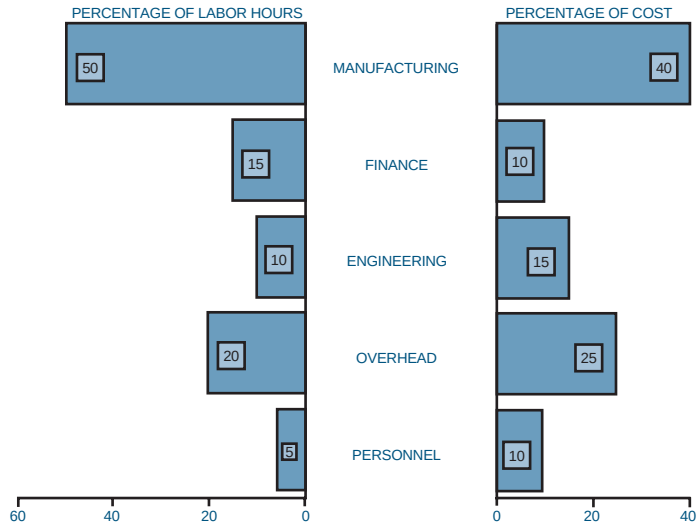

FIGURE 13–12. Divisional breakdown of costs and labor hours.

13.3 OTHER CONVENTIONAL PRESENTATION TECHNIQUES

Bar charts serve as a useful tool for presenting data at technical meetings. Unfortunately, programs must be won competitively or organized in-house before technical meeting presentations can be made. Competitive proposals or in-house project requests should contain descriptive figures and charts, not necessarily representing activities, but showing either planning, organizing, tracking, or technical procedures designed for the current program or used previously on other programs. Proposals generally contain figures that require either some interpolation or extrapolation. Figure 13–13 shows the breakdown of total program costs. Although this figure would also normally require interpretation, a monthly cost table accompanies it. If the table is not too extensive, then it can be included with the figure. This is shown in Figure 13–14. During proposal activities, the actual and cumulative delivery columns, as well as the dotted line in Figure 13–14, would be omitted, but would be included after updating for use in technical interchange meetings. It is normally a good practice to use previous figures and tables whenever possible because management becomes accustomed to the manner in which data are presented.

Another commonly used technique is schematic models. Organizational charts are schematic models that depict the interrelationships between individuals, organizations, or functions within an organization. One organizational chart normally cannot suffice for describing total program interrelationships. Figure 4–8 identified the Midas Program in relation to other programs within Dalton Corporation. The Midas Program is indicated by the bold lines. The program manager for the Midas Program was placed at the top of the column, even though his program may have the lowest priority. Each major unit of