5. Once the change order has been completed and approved, the project plan should be amended to reflect the change, and the change order becomes a part of the project plan.

The process of controlling change is not complicated. If the project is large, a change control board needs to be constituted. This is a group representing all interested parties that processes all requests for change. For the typical small- or medium-sized project, however, the problem of handling change need not be complex. The main source of trouble is that too many PMs, in an attempt to avoid anything that smacks of bureaucracy, adopt an informal process of handling requests for change. Misunderstanding often arises from this informality, and the PM finds that the project becomes committed to deliver a changed output of extended scope, but will have to swallow the additional cost involved, and will have to scramble to meet the old, unchanged schedule.

The problems associated with dealing with change orders informally are particularly severe in the case of software and information system projects. The severity of the problem of dealing with change in software projects, it seems to us, is caused by two interrelated factors. First, software and information systems experts too often fail to explain adequately to the client the real nature of the systems they develop. Second, clients too often fail to make an adequate effort to understand the systems that become the lifeblood for their organizations. The development of *Agile* approaches for managing IT projects, or the use of the formal process for change suggested above, should help to reduce the degree of misunderstanding and disappointment.

A senior executive at a large industrial firm that carries out many projects each year sees control in a slightly different light. Noting that differences between plan and reality usually represent problems for project managers, he remarked: "If you are solving problems faster than they are arriving to be solved, you have the project under control. If not, you haven't."

Difficult as it may be, control is an important part of the PM's job on every project. Perhaps the most helpful advice we can give the PM is, in the language of the 1970s, to "hang loose." One effective PM of our acquaintance tells his project team, "I will not accept crises after 4:30 P.M. You are limited to one crisis per day. Crises are not cumulative. If

Project Management in Practice

Better Control of Development Projects at Johnson Controls

The Automotive Systems Group of Johnson Controls was having trouble controlling their product development programs with each project being managed differently, disagreements about who was responsible for what, projects failing because of rapid company growth, and new employees having trouble fitting into the culture. For a solution, they went to their most experienced and successful PMs and condensed their knowledge into four detailed procedures for managing projects. Because these procedures are now common to all projects, they can be used to train new employees, standardize practices, create a common language, tie together different company functions, create common experiences, act as implicit job descriptions, and create a positive overall project management culture.

The first procedure is project approval for authorizing the expenditure of funds and use of resources. The sales department must first provide a set of product/market information, including financial data, project scope, critical dates, and engineering resource requirements before management will approve the project. Thus, projects are now scrutinized much more closely before work is started and money spent—when more questions are asked and more people are involved, better decisions tend to be made.

The second procedure is the statement-of-work, identifying agreements, and assumptions for the project. Here, both the customer and top management must sign off before product design work begins, thereby reducing misunderstandings regarding not only product specifications, prices, and milestones but also intangible product requirements, explicit exclusions, and generic performance targets. Maintaining

this documentation over the life of the project has helped avoid problems caused by late product changes from the customer, particularly for 3- to 5-year projects where the personnel rotate off the project. Customers have, however, been slow to agree to this level of documentation because it limits their ability to change timing, prices, and specifications late in the program when they are more knowledgeable about their needs.

The third procedure is the work breakdown structure, consisting of nine critical life-cycle phases running from definition through production. Included in each of these nine phases are four key elements: the tasks, the timing of each task, the responsible individuals, and the meeting dates for simultaneous engineering (a formalized procedure at Johnson Controls).

The fourth procedure is a set of management reviews, crucial to successful project completion. Both the content and timing of these reviews are specified in advance and progression to the next phase of a project cannot occur until senior management has approved the prespecified requirements, objectives, and quality criteria for that phase. The procedure also specifies questions that must be answered and work that must be reviewed by senior management.

Through the use of these procedures, which are updated and improved with each new project experience, the learning that occurs in the organization is captured and made useful for future projects.

Questions

1. **Summarize the unique way Johnson achieved control over their projects.**
2. **How did "scope creep" enter the projects in the past? Which procedure is now directed at controlling this effect?**
3. **Which of the four procedures is probably most critical to successful projects?**
4. **What is the term used in the chapter for the senior management review described in the fourth procedure?**

Source: W. D. Reith and D. B. Kandt, "Project Management at a Major Automotive Seating Supplier," *Project Management Journal*, Vol. 22.

you don't get yours in today, you do not get two tomorrow." All this is said, of course, with good humor. Team members understand that the PM is not serious, but his projects seem to progress with exceptional smoothness. Crises do occur from time to time, but everyone on the team works to prevent them by applying control in an effective and timely manner.

Controlling Creative Activities

Some brief attention should be paid to the special case of controlling research and development projects, design projects, and similar processes that depend intimately on the creativity of individuals and teams. First, the more creativity involved, the greater the degree of uncertainty surrounding outcomes. Second, too much control tends to inhibit creativity. But neither of these dicta can be taken without reservation. Control is necessarily neither the enemy of creativity nor, popular myth to the contrary, does creative activity imply complete uncertainty. While the exact outcomes of creative activity may be more or less uncertain, the process of getting the outcome is usually not uncertain. If the potential payoff for the creative activity is high, the need for careful risk management is also high.

In order to control creative projects, the PM must adopt one or some combination of three general approaches to the problem: (1) process review, (2) personnel reassignment, and (3) control of input resources.

Process Review The process review focuses on the process of reaching outcomes rather than on the outcomes per se. Because the outcomes are partially dependent on the process used to achieve them, uncertain though they may be, the *process* is subjected to control. For example, in research projects, the researcher cannot be held responsible for the outcome of the research, but can most certainly be held responsible for adherence to the research proposal, the budget, and the schedule. The process is controllable even if the precise results are not.

Control should be instituted at each project milestone, an obvious opportunity for phase-gate controls. If research results are not as expected or desired, milestones provide a convenient opportunity to assess the state of progress, the value of accomplishment to date, the probability of valuable results in the future, and the desirability of changes in the research design. Again, the object of control is to ensure that the research design is sound and is being carried out as planned or amended. The review process should be participative. Unilateral judgments from the superior are not apt to be accepted or effective. Care must be taken not to overstress method as opposed to result. Method is controllable, and should be controlled, but results are still what count.

Personnel Reassignment This type of control is straightforward—individuals who are productive are kept; those who are not are moved to other jobs or to other organizations. Problems with this technique can arise because it is easy to create an elite group. While the favored few are highly motivated to further achievement, everyone else tends to be demotivated. It is also important not to apply control with too fine an edge. While it is not particularly difficult to identify those who fall in the top and bottom quartiles of productivity, it is usually quite hard to make clear distinctions between people in the middle quartiles.

Control of Input Resources In this case, the focus is on efficiency. The ability to manipulate input resources carries with it considerable control over output. Obviously, efficiency is not synonymous with creativity, but the converse is equally untrue—creativity is not synonymous with the extravagant use of resources.

The results flowing from creative activity tend to arrive in batches. Considerable resource expenditure may occur with no visible results, but then, seemingly all of a sudden, many outcomes may be delivered. The milestones for application of resource control must therefore be chosen with great care. The controller who decides to withhold resources just before the fruition of a research project is apt to become an ex-controller.

Sound judgment argues for some blend of these three approaches when controlling creative projects. The first and third approaches concentrate on process because process is observable and can be affected. But process is not the matter of moment; results are. The second approach requires us to measure (or at least to recognize) output when it occurs. This is often quite difficult. Thus, the wise PM will use all three approaches: checking process and method, manipulating resources, and culling those who cannot or do not produce.

In the next chapter, we initiate the project closure part of the text, beginning with evaluation and auditing. This topic is closely related to the postcontrol topics in this chapter.

Summary

As the final subject in the project implementation part of the text, this chapter described the project control process in the planning–monitoring–controlling cycle. The need for control was discussed, and the three types available were described. Then the design of control systems was addressed, including management's role, achieving the proper balance, and attaining control of creative activity as well as handling changes.

- Control is directed to scope, cost, and time.
- The two fundamental purposes of control are to regulate results through altering activity and to conserve the organization's physical, human, and financial assets.
- The three main types of control processes are cybernetic, go/no-go, and postcontrol.