Chapter 8: Monitoring and Controlling Projects

Note: See the text itself for full citations. Text Web site is www.intropm.com.

Learning Objectives

▸ List several processes and outputs of project monitoring and controlling, and describe outputs common to all knowledge areas

▸ Discuss monitoring and controlling project work and performing integration change control as part of project integration management and how to use earned value management

▸ Explain the importance of validating and controlling scope

▸ Describe the schedule control process and schedule performance measurement tools, such as tracking Gantt charts

Learning Objectives (continued)

- Discuss tools and techniques to assist in cost control
- List the Seven Basic Tools of Quality, and provide examples of how they assist in performing quality control
- Summarize methods for controlling communications
- Discuss different approaches to controlling stakeholder engagement
- Describe the process of controlling risks
- Explain how to control procurements
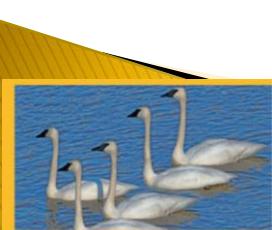
Introduction

▸ Monitoring and controlling involves regularly measuring progress to ensure that the project is meeting its objectives and addressing current business needs

▸ The project manager and other staff monitor progress against plans and take corrective action when necessary

Figure 8-1. Summary of Monitoring and Controlling Outputs

Knowledge area	Monitoring and controlling process	Outputs
Project integration management	Monitor and control project work	Change requests Work performance reports Project management plan updates Project document updates Approved change requests
	Perform integrated change control	Change log Project management plan updates Project documents updates
Project scope management	Validate scope	Accepted deliverables Change requests Work performance information Project document updates
	Control scope	Work performance information Change requests Project management plan updates Project documents updates Organizational process assets updates
Project time management	Control schedule	Work performance information Schedule forecasts Change requests Project management plan updates Project documents updates Organizational process assets updates
Project cost management	Control cost	Work performance information Cost forecasts Change requests Project management plan updates Project documents updates Organizational process assets updates

Figure 8-1. Summary of Monitoring and Controlling Outputs (continued)

Knowledge area	Monitoring and controlling process	Outputs
Project quality management	Control quality	Quality control measurements Validated changes Validated deliverables Work performance information Change requests Project management plan updates Project documents updates Organizational process assets updates
Project communications management	Control communications	Work performance information Change requests Project documents updates Organizational process assets updates
Project stakeholder management	Control stakeholder engagement	Work performance information Change requests Project documents updates Organizational process assets updates
Project risk management	Control risks	Work performance information Change requests Project management plan updates Project documents updates Organizational process assets updates
Project procurement management	Control procurements	Work performance information Change requests Project management plan updates Project documents updates Organizational process assets updates

Project Integration Management

- Main processes include:
  - Monitoring and controlling project work, which involves collecting, measuring, and disseminating performance information as well as assessing measurements and analyzing trends to determine what process improvements can be made
  - Performing integrated change control, which involves identifying, evaluating, and managing changes throughout the project's life cycle

Forecasting With Earned Value Management

▸ **Earned value management (EVM)** is a project performance measurement technique that integrates scope, time, and cost data

▸ Given a baseline, project managers and their teams can determine how well the project is meeting scope, time, and cost goals by entering actual information and then comparing it to the baseline

▸ The baseline information includes:
  ◦ Scope data (WBS tasks)
  ◦ Time data (start and finish estimates for each task)
  ◦ Cost data (cost estimates for each task)

▸ Note that you can use earned value management at either a detailed or a summary level

Earned Value Terms

- The **planned value (PV)** is that portion of the approved total cost estimate planned to be spent on an activity during a given period

- The **actual cost (AC)** is the total direct and indirect costs incurred in accomplishing work on an activity during a given period

- The **earned value (EV)** is an estimate of the work performed expressed in terms of the budget authorized for that work. In other words, it is the budget associated with the authorized work that has been completed
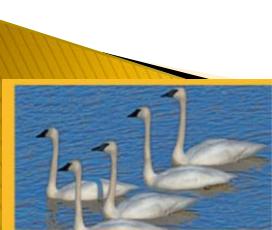
Figure 8-2. Earned Value Formulas

Term	Formula
Earned Value (EV)	EV = PV to date × RP
Cost Variance (CV)	CV = EV − AC
Schedule Variance (SV)	SV = EV − PV
Cost Performance Index (CPI)	CPI = EV/AC
Schedule Performance Index (SPI)	SPI = EV/PV
Estimate at Completion (EAC)	EAC = Budget at Completion (BAC)/CPI
Estimated Time to Complete	Original time estimate/SPI

Schwalbe, Information Technology Project Management, Sixth Edition, 2010

Figure 8-3. Earned Value Calculations For One Activity After One Week

Term or Calculation	Amount
Earned Value (EV)	$5,000
Planned Value (PV)	$5,000
Actual Cost (AC)	$6,000
Cost Variance (CV)	–$1,000
Schedule Variance (SV)	0
Cost Performance Index (CPI)	83.33%
Schedule Performance Index (SPI)	100%

Interpreting Earned Value Numbers

‣ In general, *negative numbers for cost and schedule variance indicate problems in those areas*

‣ Negative numbers mean the project is costing more than planned or taking longer than planned

‣ Likewise, *CPI and SPI less than one or less than 100 percent indicate problems*
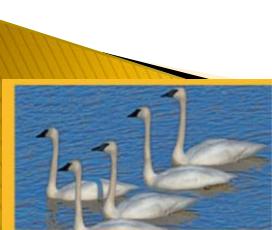
Study on EVM Practice

▸ PMI conducted a study in 2011 to help understand and gauge the current level of EVM practice.

▸ The researchers surveyed more than 600 project management practitioners in 61 countries

▸ Key findings:

  ◦ EVM is used worldwide, and it is popular in the Middle East, South Asia, Canada, and Europe

  ◦ Most countries require EVM for large defense or government projects

  ◦ Project budget size appears to be the most important factor in deciding whether or not to use EVM

Figure 8-4. Percentage of Organizations Using Earned Value
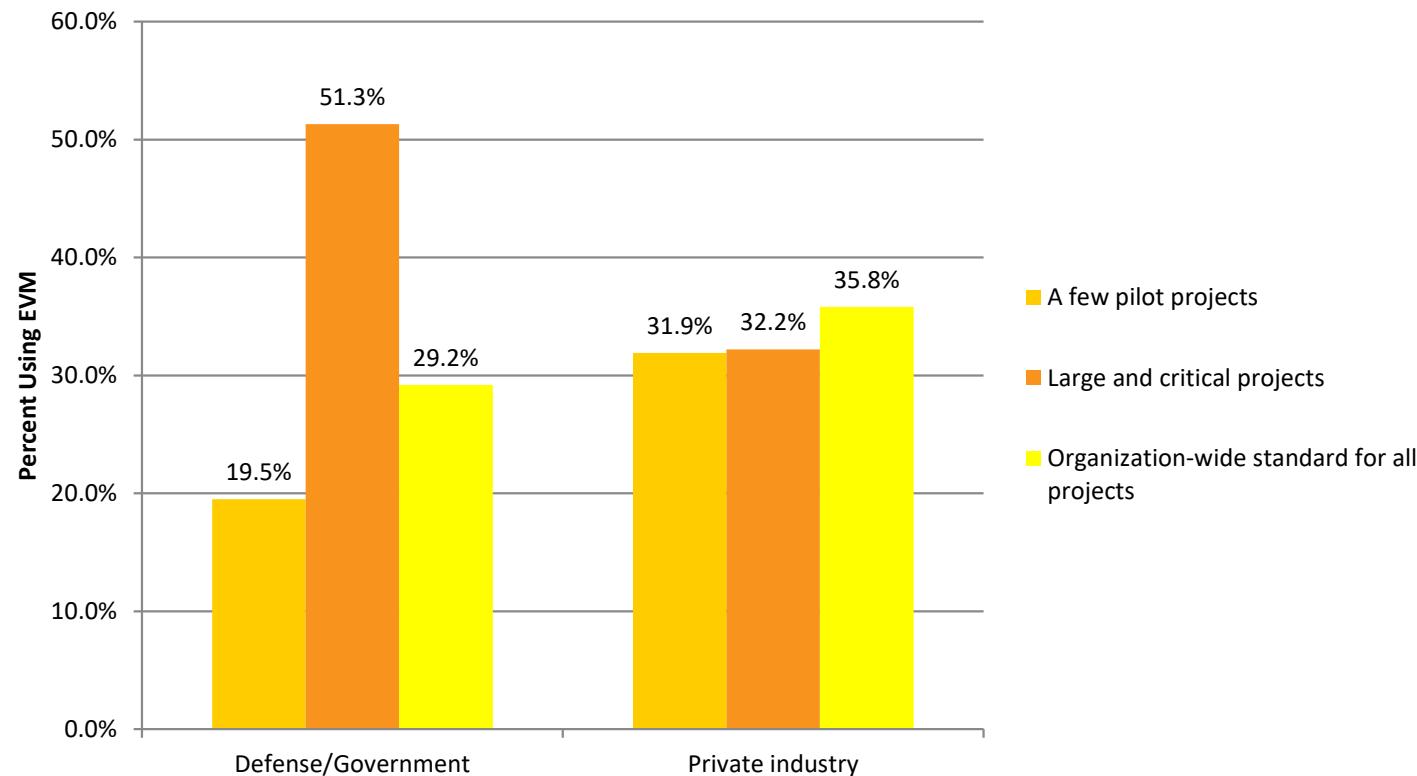
Source: Lingguang Song, "Earned Value Management: A Global and Cross-Industry Perspective on Current EVM Practice," PMI (2011).

Sample Forecast Using an Earned Value Chart

▸ The **budget at completion (BAC),** or the approved total budget for the project, can be divided by the cost performance index to calculate the **estimate at completion (EAC),** which is a forecast of how much the project will cost upon completion

▸ Likewise, the approved time estimate for the project can be divided by the schedule performance index to calculate when the project will be completed

- ◦ CPI = EV/AC = $900,000/$1,200,000 = .75
- ◦ SPI = EV/PV = $900,000/$600,000 = 1.5
- ◦ EAC = BAC/CPI = $1,200,000/.75 = $1,600,000
- ◦ New time estimate = Original time estimate / SPI = 12 months/1.5 = 8 months

▸ Earned value, therefore, provides an excellent way to monitor project performance and provide forecasts based on performance to date

Figure 8-5. Sample Earned Value Chart
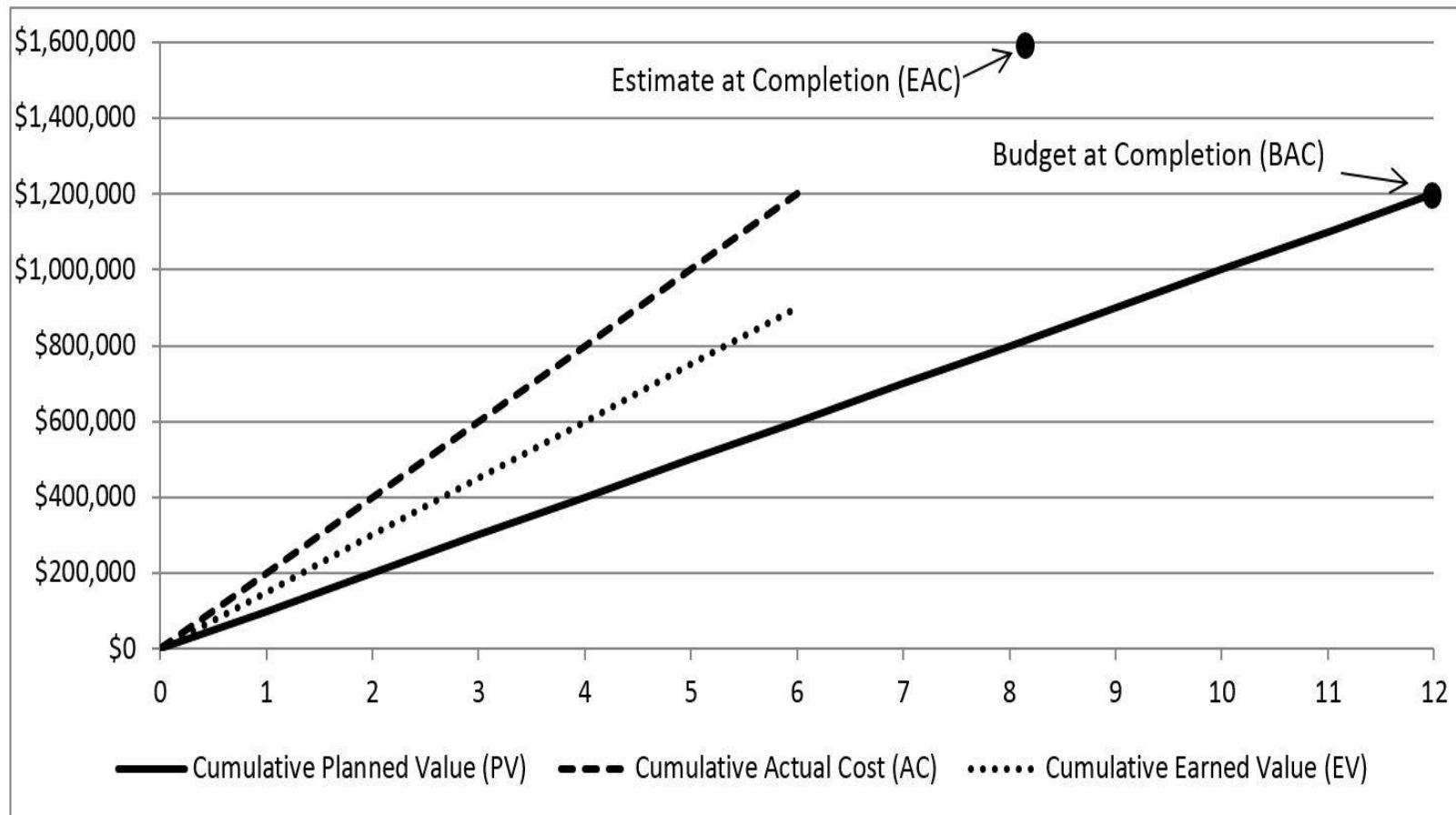
Integrated Change Control

- Integrated change control involves identifying, evaluating, and managing changes throughout the project's life cycle
- Objectives are as follows:
  - Influence the factors that cause changes to ensure that changes are beneficial
  - Determine that a change has occurred
  - Manage actual changes as they occur
- The project management plan provides the baseline for identifying and controlling project changes

Project Scope Management

- The main monitoring and controlling processes performed as part of project scope management are validating scope and controlling scope
- Key outputs are deliverables that are accepted by the customer and work performance information
- It is difficult to create a good project scope statement and WBS; it is often even more difficult to validate the project scope and minimize scope changes

Scope Creep

- Even when the project scope is fairly well defined, many projects suffer from scope creep—the tendency for project scope to grow bigger and bigger
- There are many horror stories about projects failing due to scope creep
- Even for fairly simple projects, people have a tendency to want more
- How many people do you know, for example, who said they wanted a simple wedding or a basic new house constructed, only to end up with many more extras than they initially planned?

Validating Scope

▸ **Scope validation** involves formal acceptance of the completed project deliverables by the project customer or designated stakeholders

▸ Acceptance is often achieved through customer *inspection* and then *sign-off* on key deliverables

▸ A **validated deliverable** has been completed and checked for correctness as part of quality control

▸ The customer is often more than one person, so group decision-making is often required for the inspection and acceptance

Figure 8-6. Sample Deliverable Acceptance Form (partial)

1. Was this deliverable completed to your satisfaction?   Yes_____No X

2. Please provide the main reasons for your satisfaction or dissatisfaction with this deliverable.

As stated in the contract statement of work, the course materials are not completed until all constructive feedback from the prototype course has been incorporated or the supplier has provided strong rationale as to why the feedback should not be incorporated. We requested that a new section be added to the course to cover issues related to working with suppliers in virtual settings. The final materials delivered did not include this new section or discuss why it was not added. We believe it was an oversight that can be corrected with a minimal amount of additional work.

3. If the deliverable is not acceptable, describe in detail what additional work must be done to complete it.

The supplier will add a new section to the course on working with suppliers in a virtual setting. This section should take about thirty minutes of class time in a face-to-face or e-learning setting. This new section will follow the format and review process used for other topics in the course. We request delivery of the draft of this new section within one week and the final delivery within two weeks.

Controlling Scope

- You cannot control the scope of a project unless you have first clearly defined the scope and set a scope validation process in place

- You also need to develop a process for soliciting and monitoring changes to project scope; stakeholders should be encouraged to suggest beneficial changes and discouraged from suggesting unnecessary changes

- For example, some parents provide a fixed budget for a child's wedding and honeymoon and let the young couple decide how to spend it. If the couple minimizes and controls the scope of the wedding, they can have extra money to pay off other debts or save for a down payment on a home. If they suffer from scope creep, they may not have any money for a honeymoon or become further in debt

Best Practice

- Northwest Airlines developed a new reservation system in the late 1990s that took several years and millions of dollars to develop

- They knew that users would request changes and enhancements to the system, so they built in a special function key for submitting change requests and assigned three full-time programmers to work exclusively on them

- Users made over 11,000 enhancement requests the first year the system was in use, which was much more than the three programmers could handle

- Although they only implemented 38% of the requested enhancements, these were the most important, and users were very satisfied with the system and process

Project Time Management

- The main monitoring and controlling process performed as part of project time management is controlling the schedule or schedule control
- Project managers often cite delivering projects on time (schedule control) as one of their biggest challenges, because schedule problems often cause more conflict than other issues
- During project initiation, priorities and procedures are often most important, but as the project proceeds, especially during the middle and latter stages of the project, schedule issues become the predominant source of conflict

Why Schedules Cause Conflicts

▸ Time is the variable with the least amount of flexibility; time passes no matter what happens on a project

▸ Individual work styles and cultural differences may also cause schedule conflicts.

◦ People who prefer the "P" vs. "J" in the MBTI profile may not like having schedules and deadlines

◦ Different cultural views of time affect meeting schedules and attitudes toward work
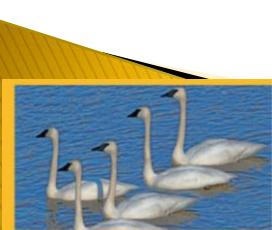
Media Snapshot

- In contrast to the 2002 Olympic Winter Games in Salt Lake City (see the Media Snapshot of Chapter 4), planning and scheduling for the 2004 Olympic Summer Games in Athens, Greece and the 2014 Sochi Winter Olympic Games did not go so well.

- The Greeks made fun of critics by having construction workers pretend to still be working on the stage as the ceremonies began. Unfortunately, the Greek government suffered a huge financial deficit because the games cost more than twice the planned budget.

- The 2014 Winter Olympic Games in Sochi, Russia suffered even more financial losses. Originally budgeted at US$12 billion, final costs reached over US$51 billion, making it the most expensive games in history.

Sample Work Performance Information

▸ The goal of schedule control is to know the status of the schedule, influence the factors that cause schedule changes, determine whether the schedule has changed, and manage changes when they occur

▸ A key output of schedule control is work performance information, which isprovided by:

◦ Indicators
◦ Milestone completion
◦ Worker morale and discipline
◦ Performance review meetings and tracking Gantt charts

Figure 8-7. Sample Schedule Performance Measurement Using a Tracking Gantt Chart

A **slipped milestone** refers to a milestone activity that was actually completed later than originally planned
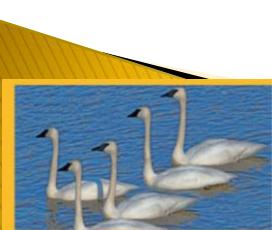
What Went Right?

▸ Chicago's Museum of Contemporary Art (MCA) provides a great example of tracking key project performance information to ensure project success. In September 2014 MCA became the first U.S. venue to stage the "David Bowie Is" exhibit.

▸ The $2 million project took thirteen months to complete. The MCA team knew they had to sell a lot of tickets for the four-month run of the exhibit—about 150,000, which was more than half if its annual average. They put metrics in place to track several key items, including ticket sales.

▸ For example, dashboard metrics helped the team decide to provide student discounts to lure more students to the exhibit, especially on Friday nights.

No Surprises

- Top management hates surprises, so the project manager must be clear and honest in communicating project status

- By no means should project managers create the illusion that the project is going fine when, in fact, serious problems have emerged

Project Cost Management

- Cost control includes monitoring cost performance, ensuring that only appropriate project changes are included in a revised cost baseline, and informing project stakeholders of authorized changes to the project that will affect costs

- Outputs include work performance information, cost forecasts, change requests, project management plan updates, product documents updates, and updates to organizational process assets, such as lessons-learned documents

Tools and Techniques for Controlling Costs

▸ Earned value

▸ Forecasting

▸ **To-complete performance index (TCPI):** This index is the cost performance that must be achieved on the remaining work in order to meet a specified goal, such as the BAC or EAC

▸ Performance reviews

▸ Variance analysis

▸ Project management software

▸ Reserve analysis

What Went Wrong?

- Many people have heard about the problems with Boston's Big Dig project

- Newspapers and Web sites showed the many leaks in the eight- to ten-lane underground expressway that took over 14 years and $14 billion to build. Did the project overseers cut corners to save time and money?

- Representative Stephen F. Lynch believes the answer to that question is yes, and that at some point, pressure to get the project done distracted Bechtel/Parsons Brinckerhoff from getting the project done right

Project Quality Management

- Key outputs of quality control include quality-control measurements, validated changes, validated deliverables, work performance information, change requests, project management plan updates, project documents updates, and organizational process assets updates
- Outcomes are acceptance decisions, rework, and process adjustments

Seven Basic Tools of Quality

- **Cause-and-effect diagrams**: Help you find the root cause of quality problems
- **Control charts**: Illustrate the results of a process over time and show if a process is in control
- **Run charts**: Display the history and pattern of variation of a process over time. (Note: PMBOK Guide, Fifth Edition, lists checksheets or tally sheets instead of run charts)
- **Scatter diagrams**: Show if there is a relationship between two variables
- **Histograms**: Show a bar graph of a distribution of variables
- **Pareto charts**: Help you identify and prioritize problem areas
- **Flowcharts**: Display the logic and flow of processes that help you analyze how problems occur and how processes can be improved

Figure 8-8. Sample Cause-and Effect Diagram
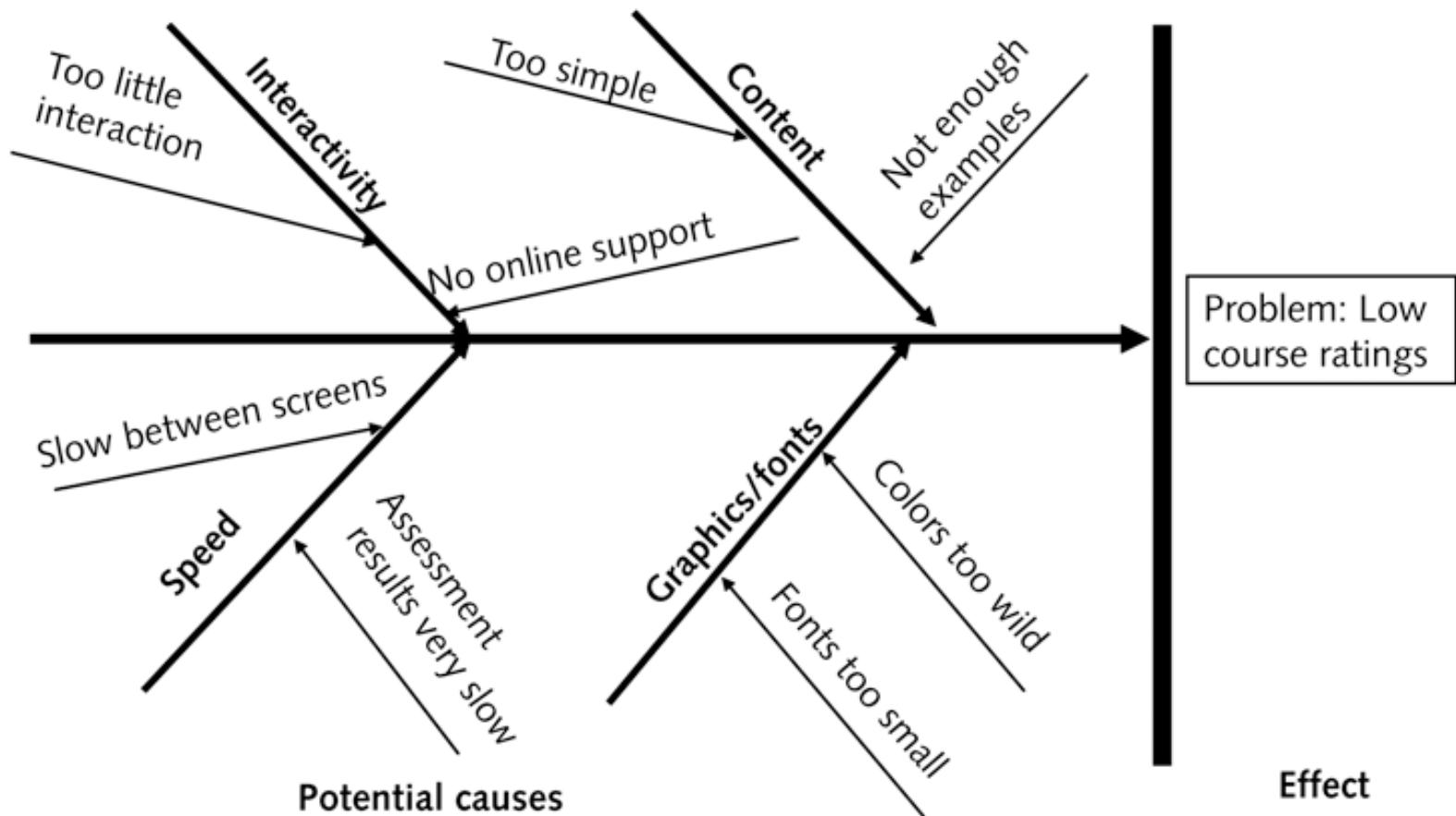
Figure 8-9. Sample Control Chart
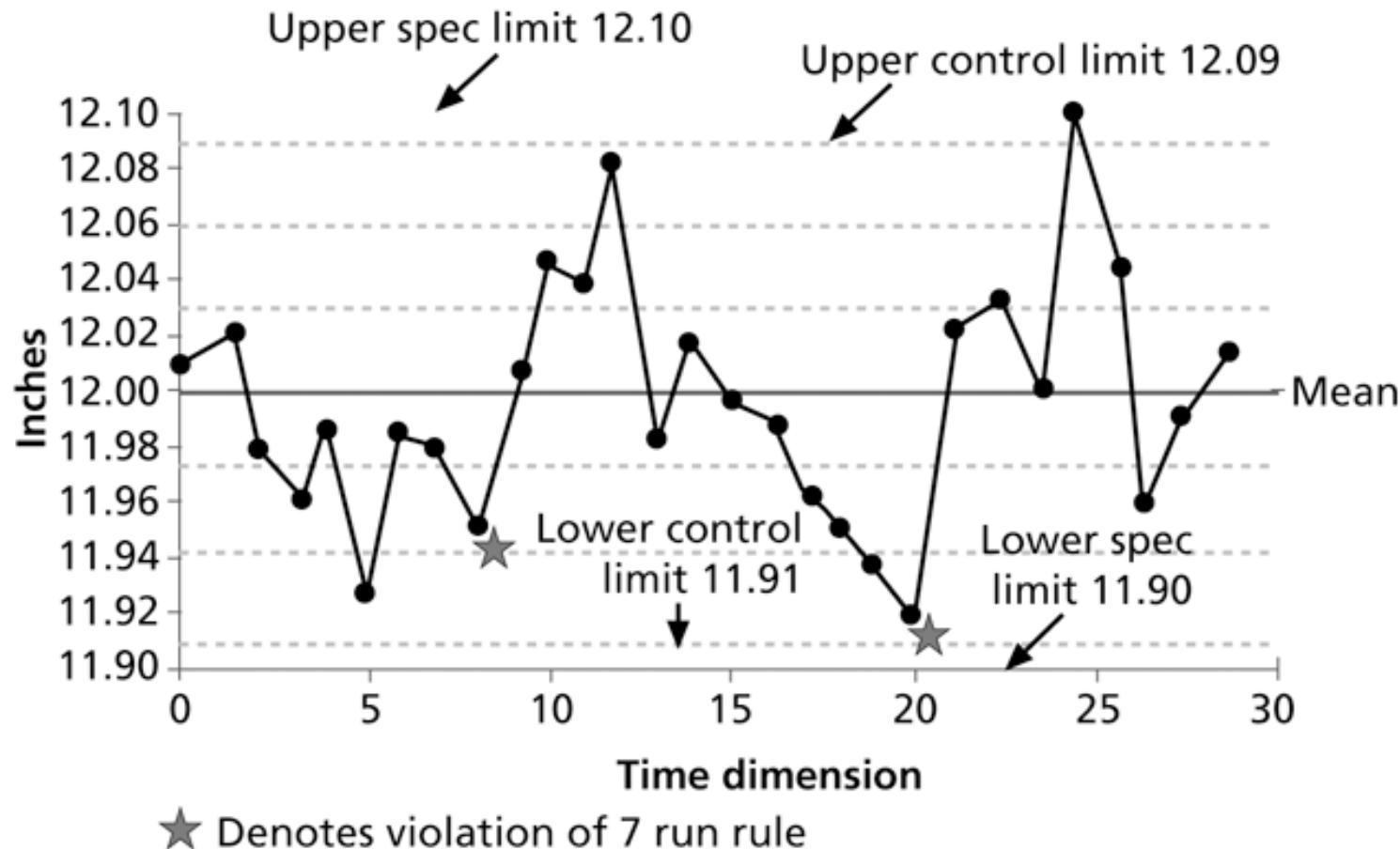
Schwalbe, Information Technology Project Management, Sixth Edition, 2010

Figure 8-10. Sample Run Chart
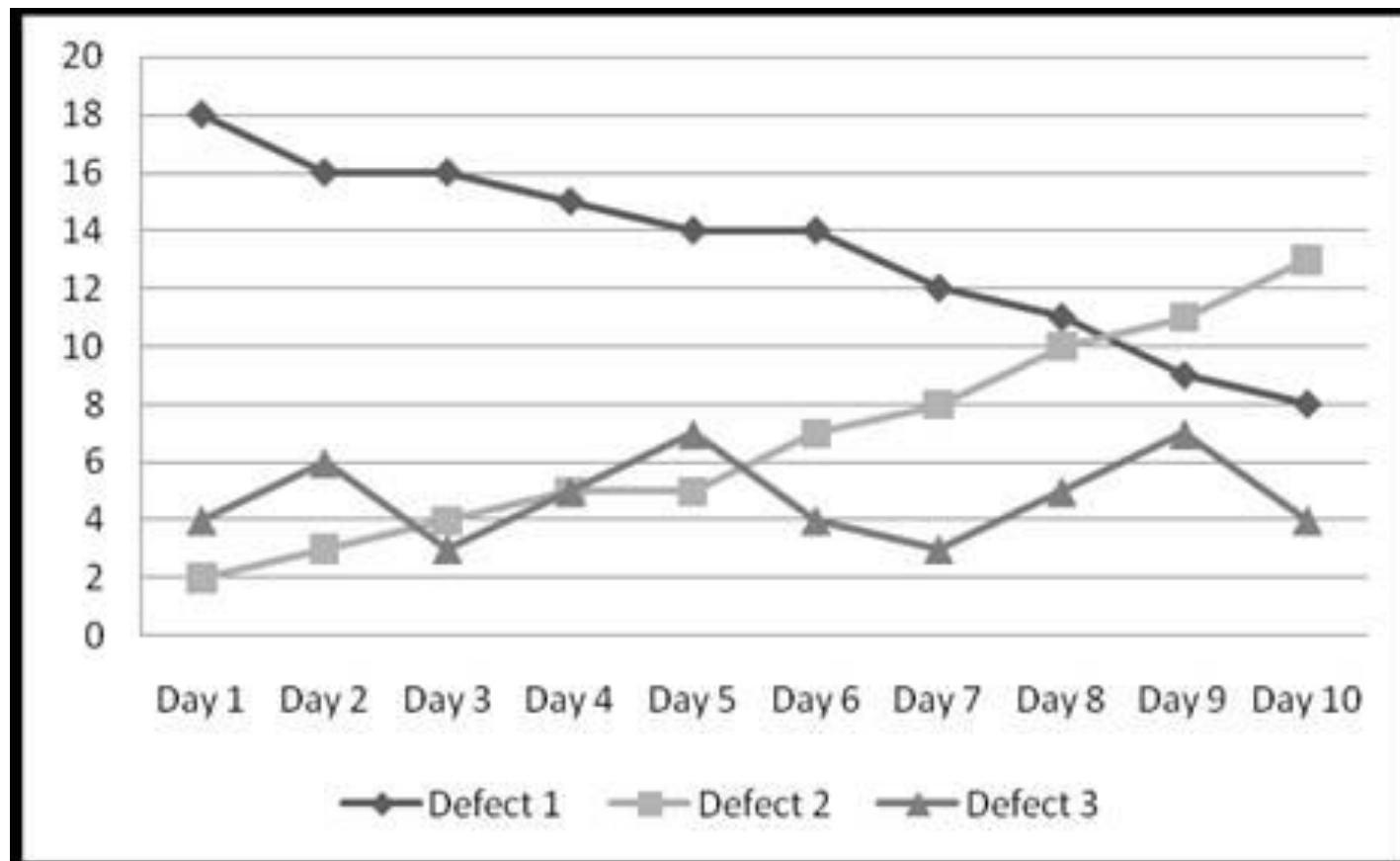
Figure 8-11. Sample Scatter Diagram
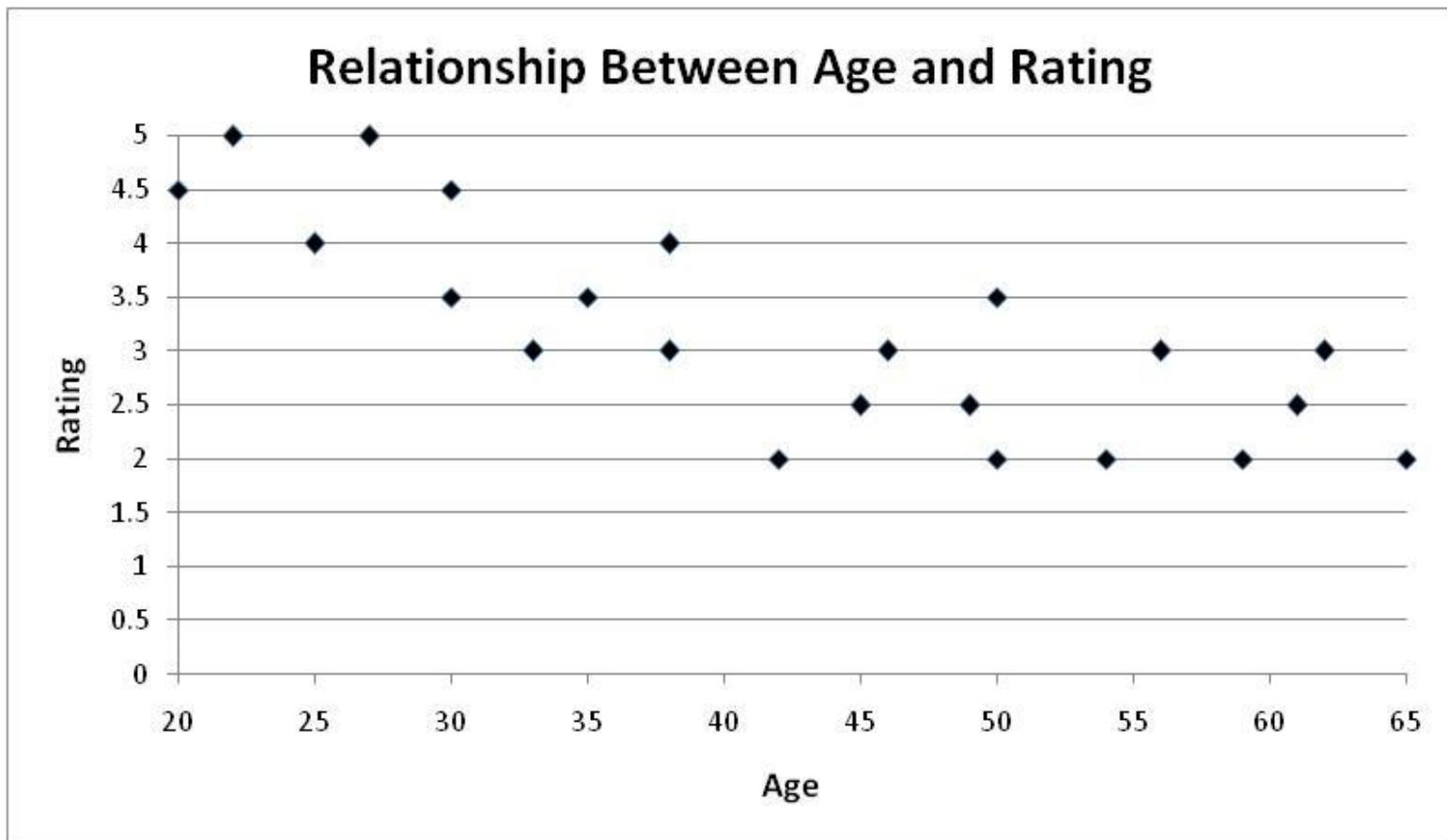
Figure 8-12. Sample Histogram
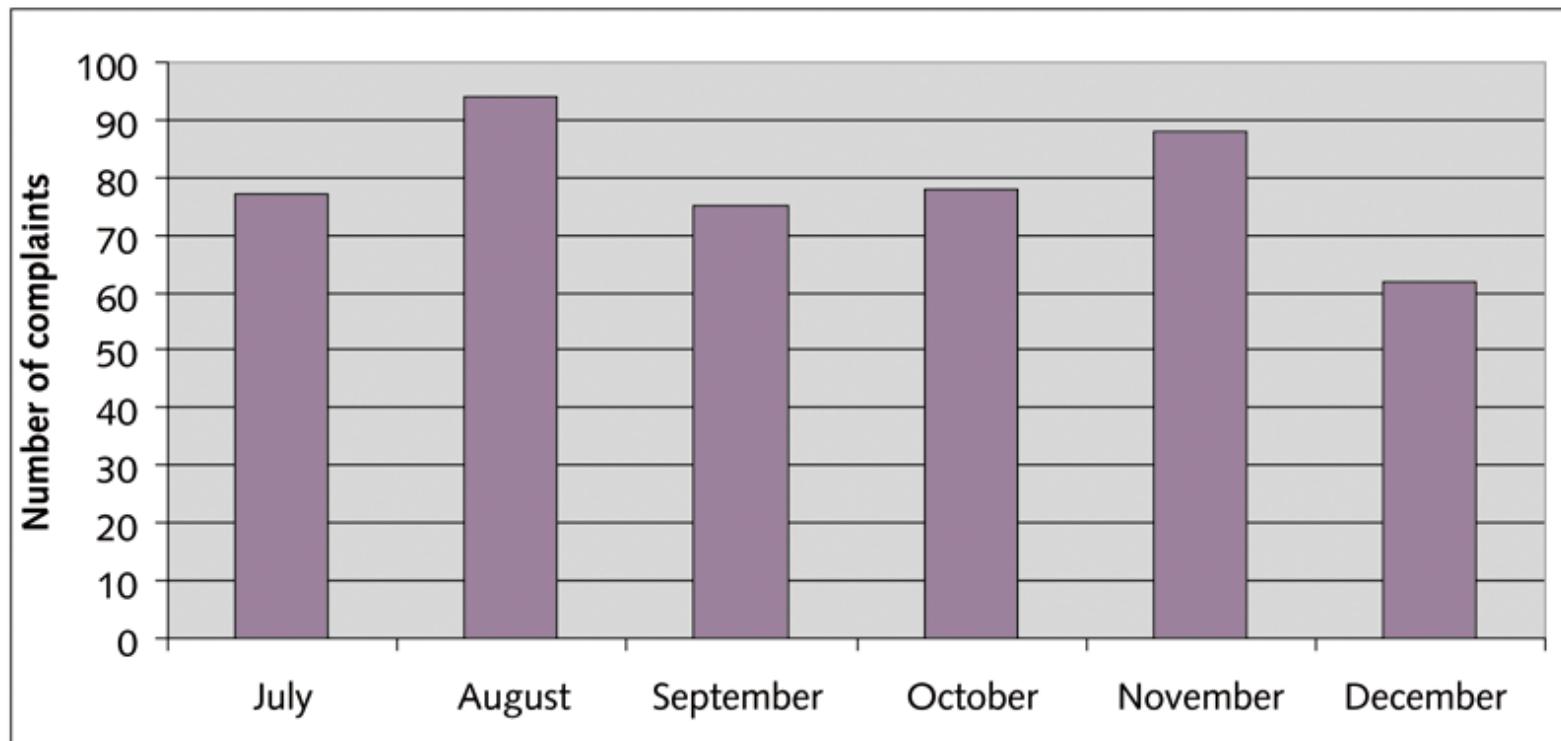
Figure 8-13. Sample Pareto Chart
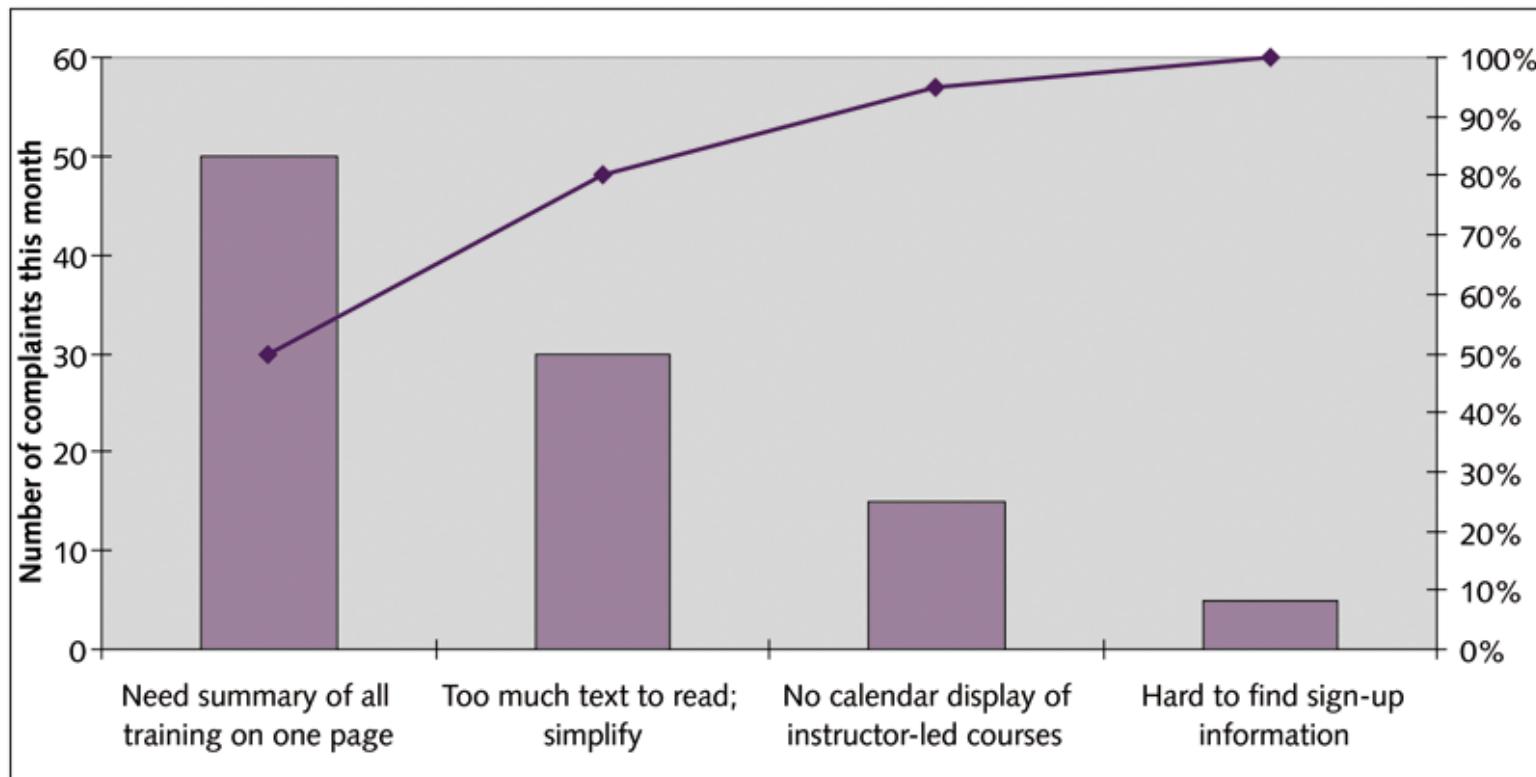
# Figure 8-14. Sample Flowchart
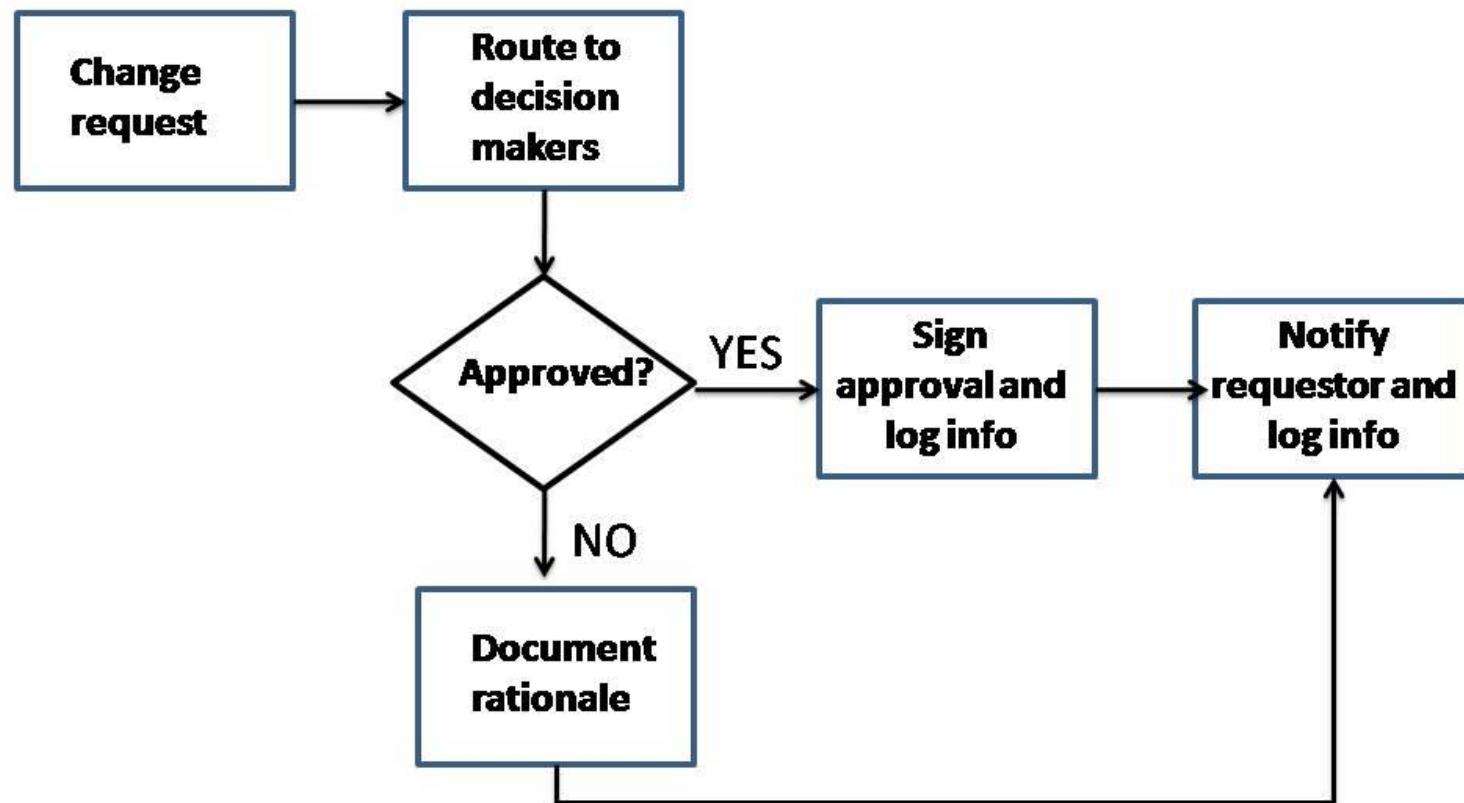
Figure 8-15. A Statistically Significant Relationship (www.xkcd.com)
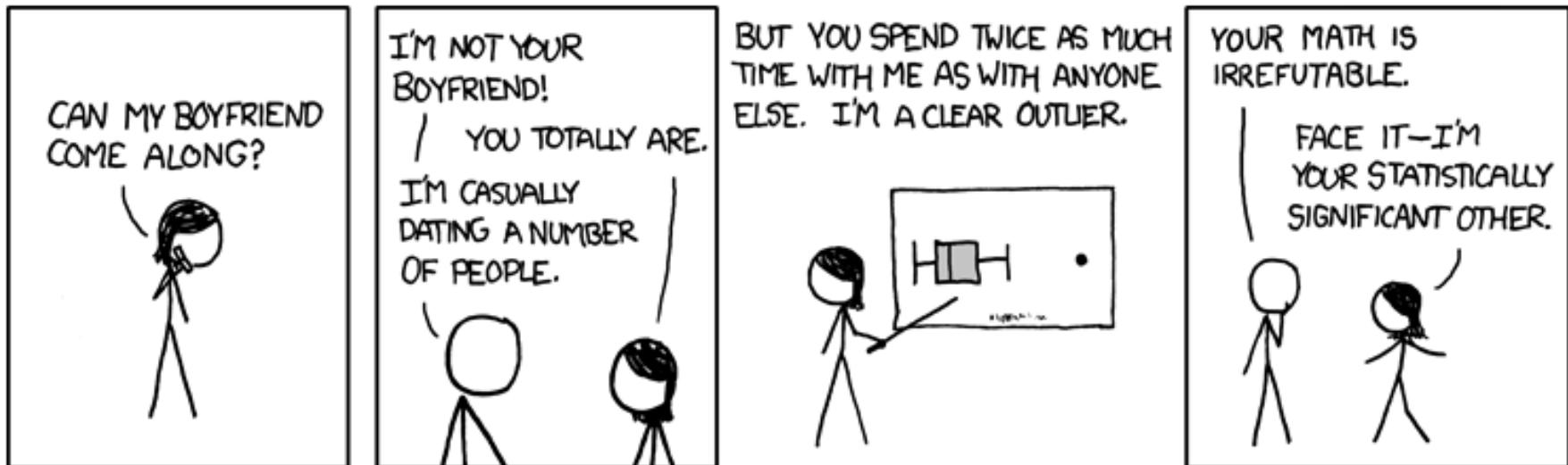
Project Communications Management

▸ Controlling communications involves monitoring and controlling communications throughout the project life cycle to ensure that stakeholder information needs are met

▸ Key outputs include work performance information, such as performance reports, change requests, project documents updates, and organizational process assets updates

Reporting Performance

▸ Reporting performance keeps stakeholders informed about how resources are being used to achieve project objectives

  ◦ **Status reports** describe where the project stands at a specific point in time

  ◦ **Progress reports** describe what the project team has accomplished during a certain period

  ◦ **Forecasts** predict future project status and progress based on past information and trends

Figure 8-16. Sample Performance Report

Progress Report

Project Name: Just-In-Time Training Project

Project Manager Name: Kristin Maur

Date: February 3

Reporting Period: January 1 – February 1

Work completed this reporting period:

- Held first negotiating skills course (instructor-led) with 20 participants

- Held first supplier management executive course (instructor-led) with 17 participants

- Held second supplier management introductory course (instructor-led) with 20 participants

- Had 32 people begin the Web-based introductory supplier management course

- Continued developing other Web-based courses

- Prepared evaluations of all courses held to date

Work to complete next reporting period:

- Hold first advanced supplier management course

- Hold first project management course

- Hold first software applications course

Figure 8-16. Sample Performance Report (continued)

What's going well and why:
• Participation in all courses is good. Every instructor-led course was full, except the supplier management executive course. All of the courses were advertised well, and we had more than enough people sign-up for the classes. We put several people on the list for later courses after courses were filled in the registration system.
• The average course ratings were above 3.8 on a 5.0 scale. Comments were generally very positive.
• More people than expected started the first Web-based course. Development of new Web-based courses is going well.
What's not going well and why:
• We did not fill the supplier management executive course as planned. Three people could not attend at the last minute, and it was too late to get replacements. We will work on a policy to help prevent this problem in the future for all instructor-led classes.
• We were surprised that so many people started the Web-based introductory supplier management course. We can handle the numbers, but we could have done a better job at forecasting demand.
Suggestions/Issues:
• Develop a policy to handle people not being able to attend instructor-led courses at the last minute.
• Try to do a better job at forecasting demand for Web-based courses.
Project changes:
No major changes to report. The earned value chart in Attachment 1 shows planned value, actual cost, and earned value information to date. We are very close to our plans, running slightly ahead of schedule and a bit over budget.

Project Stakeholder Management

- You cannot control stakeholders, but you can control their level of engagement

- Controlling stakeholder engagement involves monitoring overall project stakeholder relationships and adjusting strategies and plans for engaging stakeholders as needed

- Outputs include work performance information, change requests, project documents updates, and organizational process assets updates

- On some projects key stakeholders are members of the project team

Video Highlights

- Many governments have had difficulties controlling large projects, especially those involving advanced technologies and many different users. For example, the state government of Victoria, Australia has a Web site for its public transportation system smart card at www.myki.com.au.

- Unfortunately, there were many problems in developing and implementing the smart cards. One 2009 YouTube video shows a news story called "Myki embarrasses the Government." A 2011 video is called "Not So Smart," and a 2012 video is called "Police could be called in to control myki barriers."

- Obviously, key stakeholders, the users of the smart card, have not been happy.

Project Risk Management

- Monitoring and controlling risks involves executing the risk management processes to respond to risk events
- Carrying out individual risk management plans involves monitoring risks based on defined milestones and making decisions regarding risks and their response strategies
- Project teams sometimes use **workarounds**—unplanned responses to risk events—when they do not have contingency plans in place
- Outputs of risk control include work performance information, change requests, project management plan updates, project documents updates (especially updating the risk register), and organizational process asset updates

Sample Risk Register Updates

▸ Recall that the number one risk event in the risk register for the Just-In-Time Training project was a poor survey response. Because the project was now halfway completed, the risk register would have to change significantly

▸ For example, senior management informed Kristin that Global Construction, Inc. was growing faster than expected, and they thought the number of people needing training would be higher than expected. This information resulted in the identification of several new risks related to accommodating this growth in trainees
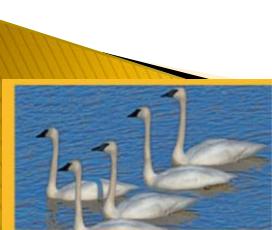
Project Procurement Management

- Controlling procurements ensures that the seller's performance meets agreements or contractual requirements
- The contractual relationship is a legal relationship and, as such, is subject to state and federal contract laws
- It is very important that appropriate legal and contracting professionals be involved in writing and administering contracts
- A key output is procurement document updates
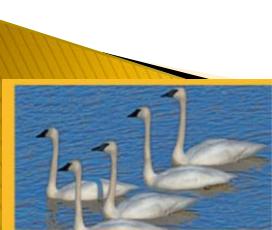
Tools and Techniques for Contract Administration

- Contract change-control system
- Procurement performance reviews
- Inspections and audits
- Performance reporting
- Payment systems
- Claims administration
- Records management system

Watch for Constructive Change Orders

- **Constructive change orders** are oral or written acts or omissions by someone with actual or apparent authority that can be construed to have the same effect as a written change order

- For example, if a project team member has met with a supplier or contractor on a weekly basis for three months to provide guidelines for performing work, he or she can be viewed as an apparent authority

- If he or she tells the contractor to redo part of a report that has already been delivered and accepted by the project manager, that action can be viewed as a constructive change order, and the contractor can legally bill the buyer for the additional work
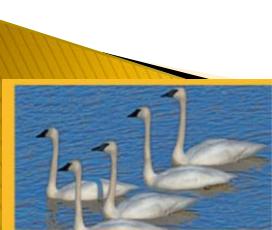
Suggestions for Controlling Procurements

- Changes to any part of the project need to be reviewed, approved, and documented by the same people in the same way that the original part of the plan was approved
- Evaluation of any change should include an impact analysis
- Changes must be documented in writing
- Project managers and their teams must stay closely involved with suppliers to make sure that their deliverables meet business needs and work in the organization's environment
- Have backup plans in case the procurement does not produce the desired results
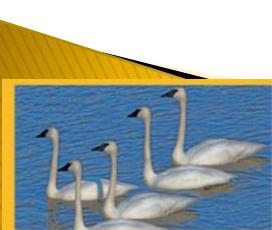
Chapter Summary

▸ Monitoring and controlling involves regularly measuring progress to ensure that the project is meeting its objectives and addressing current business needs.

▸ The project manager and other staff monitor progress against plans and take corrective action when necessary.

▸ Every knowledge area except project human resource management includes processes and outputs to help monitor and control projects.

▸ Outputs common to several knowledge areas include change requests, work performance information, organizational process assets updates, project management plan updates, and project document updates