PROJECT SCENARIOS, BUDGETING & CONTINGENCY PLANNING

(Chapter 3 – Software Project Estimation)

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Topics covered

1. Introduction
2. Project scenarios for estimation purposes
3. Probability of Underestimation & Contingency Funds
4. A Contingency Example for a Single Project
5. Managing Contingency Funds at the Portfolio Level
6. Managerial Prerogatives: An Example in the Agile Context

3.1 Introduction

Allocating budget to the software project

- This decision must be derived from:
  - An analysis of the uncertainties of the variables in input to the estimation process.
  - An understanding of the strengths and limitations of the productivity model used in the estimation process.
  - Additional contextual information.

Allocating budget to the software project

- Complementary decisions
  - A budget (project).
  - A contingency amount (project portfolio).

http://www.practicedock.com/index.cfm/PageID/7290/?p=2028

3.2 Project scenarios for estimation purposes

Estimations

http://mathsmattersresources.com/home/statistics-and-probability/

- Estimates (effort and duration) are based on limited and unreliable information available (e.g. high level requirements documents).
- The best that estimators can do in these circumstances is to:
    A. Identify a range of values
    B. Assign a probability to each scenario.

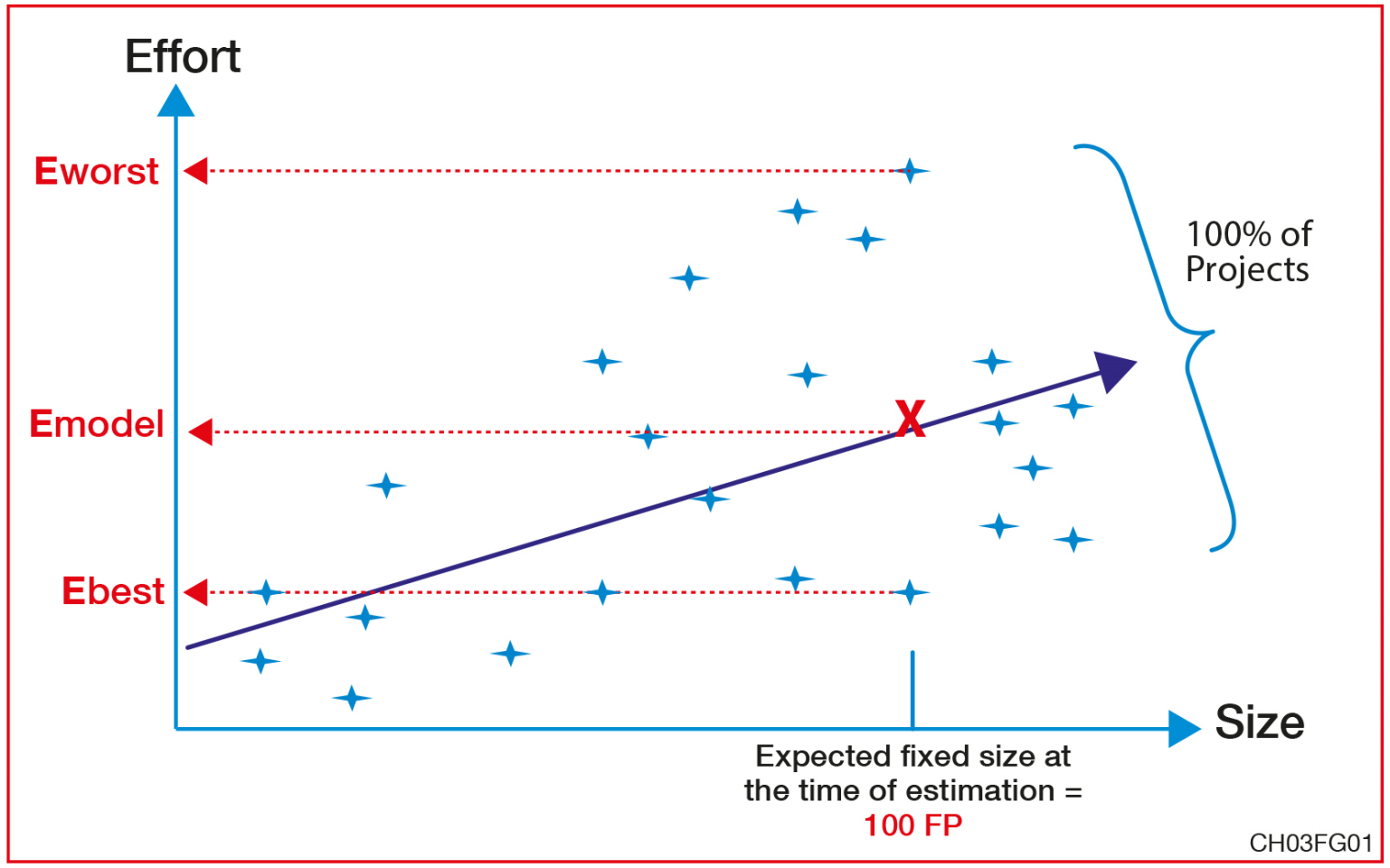
Identification of a range of values

1. The best-case scenario → very little effort (low probability of occurrence).

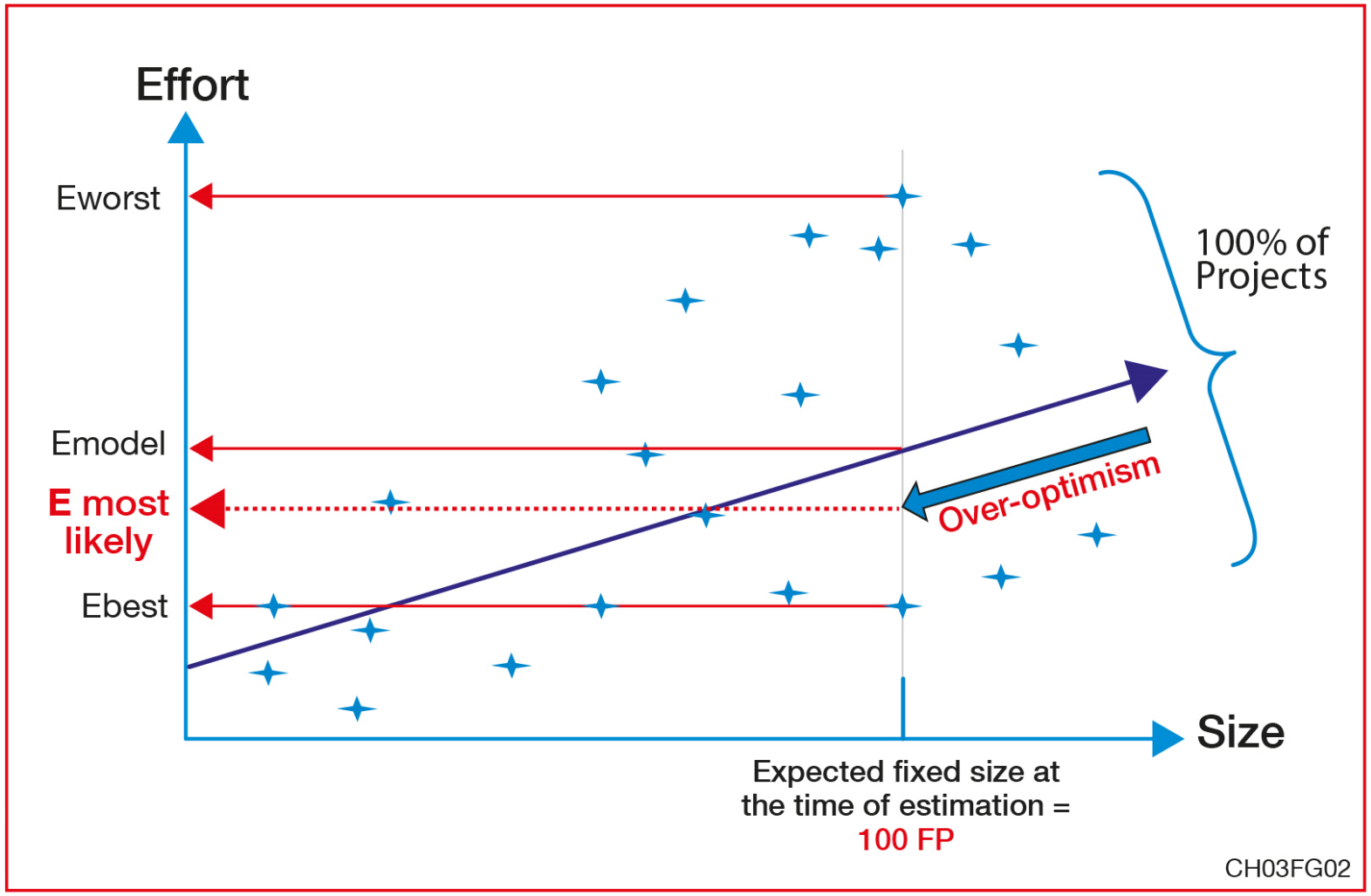
2. The most likely scenario → considerable effort (greatest probability of occurrence).

3. The worst-case scenario → very large amount of effort (low probability of occurrence).

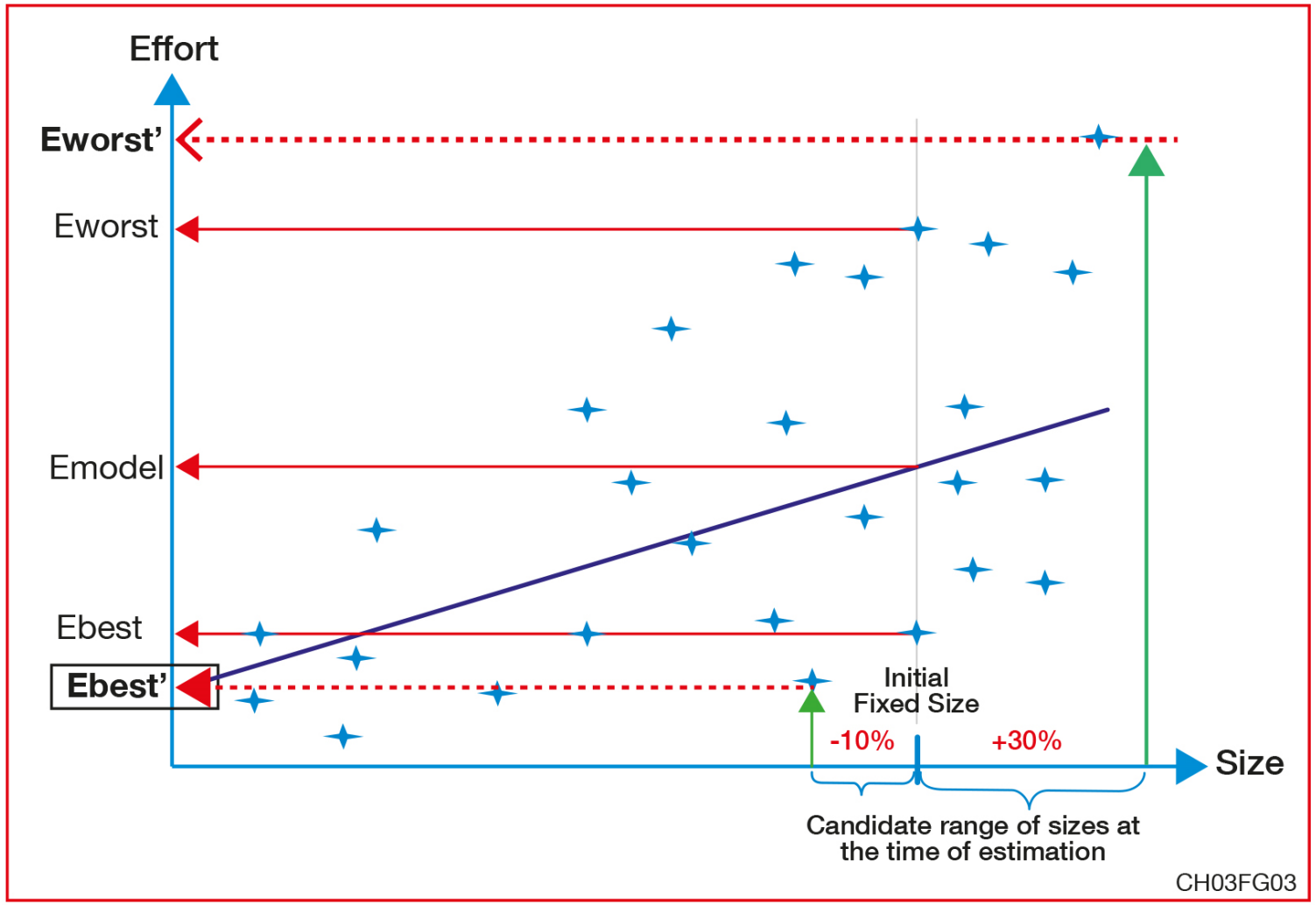
Best and Worst case scenarios



Most likely scenario and over-optimism



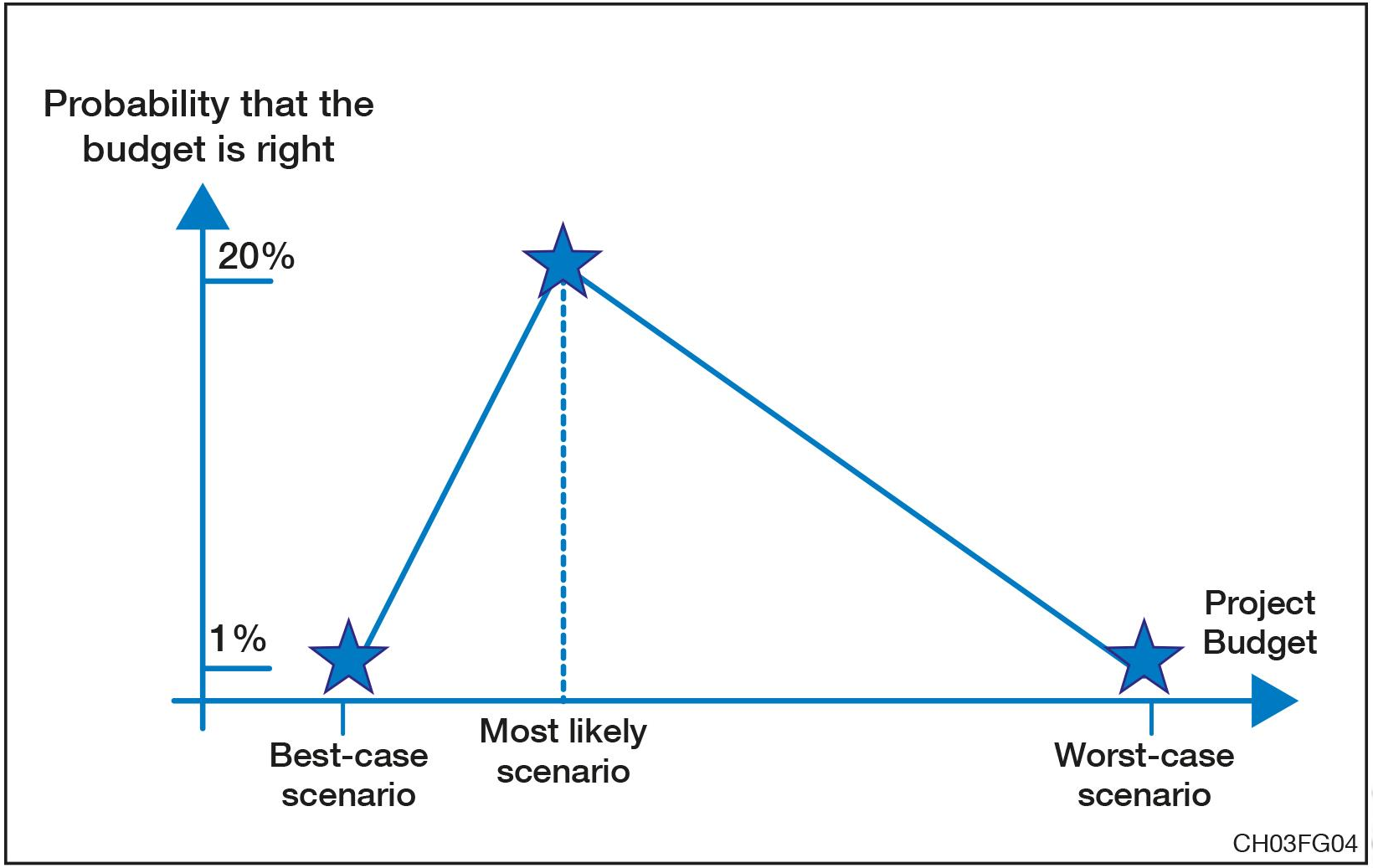
Best and Worst Scenarios and Size Uncertainty



Assignment of a probability to each scenario.

- The worst-case and best-case scenarios should have a very low probability of occurrence (e.g. 1% for each).
- The most likely scenario should have the highest probability of occurrence (e.g. a probability of 20%).
- All the other values within the range of estimates should have a decreasing probability from the maximum to the lowest probability (triangular probability distribution).

Probability distribution of scenarios



3.3 Probability of Underestimation & Contingency Funds

Choosing an scenario.

- Best-case scenario → cost overruns and shortcuts
- Worst-case scenario → failure to get the job (i.e. too much money for extras, too long a schedule, and loss of business opportunities)
- Most likely scenario is perceived to have the greatest chance of being 'accurate'.

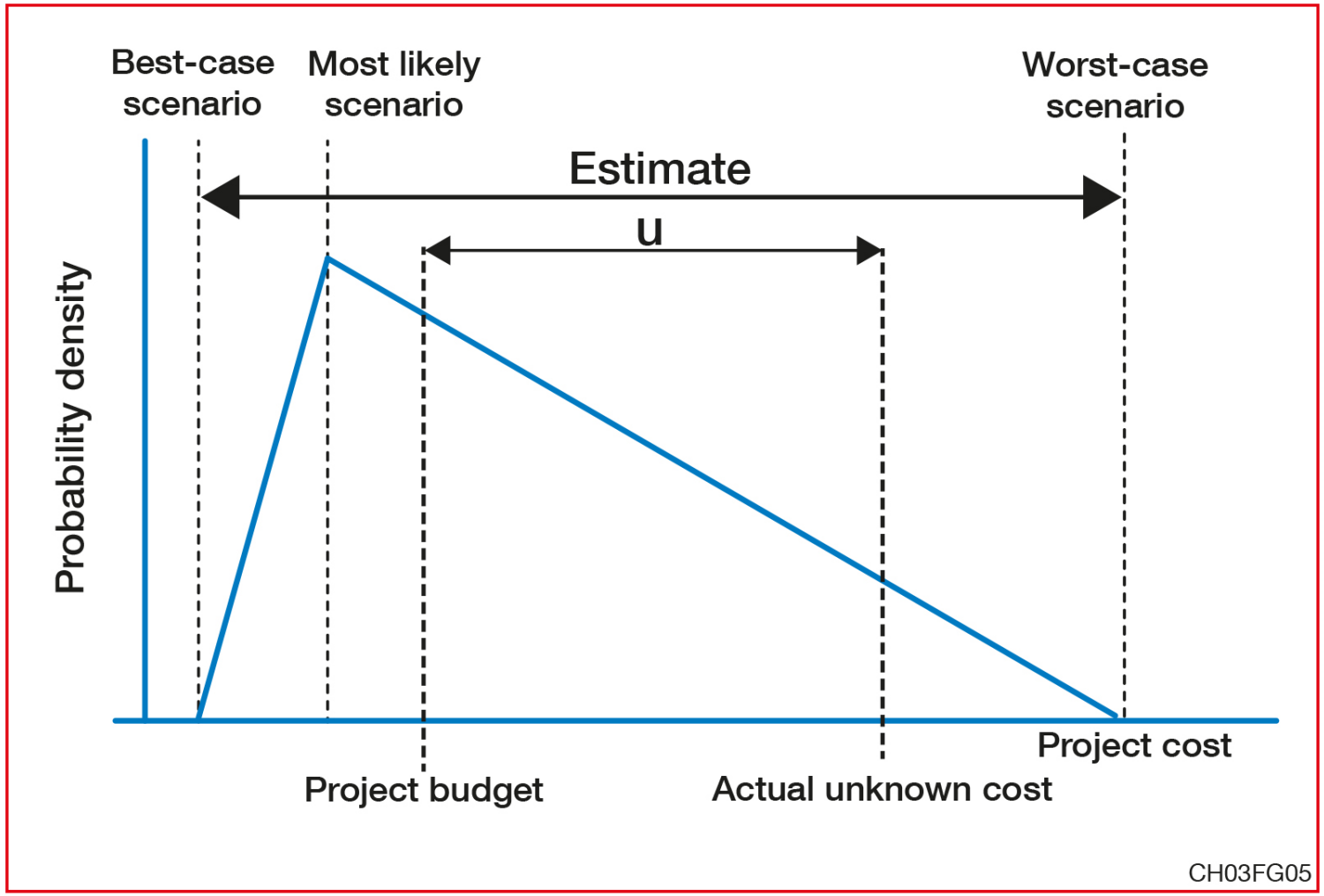
http://alwaysimages.it/i/choosing/

Underestimation

- Software staff are usually optimists –– even though most of their project estimates are wrong!
- The software staff may be influenced either by customers or managers, or both, looking for the best deals (i.e. project effort as low as possible).

http://alwaysimages.it/i/choosing/

The budget as a target



The budget as a target out of large number of estimated values.

Whatever estimated value is selected as the ‘budget’ there is a high probability in software projects that it will be proven to be inaccurate.

Most projects are underfunded when project budgets are set up.

http://www.somarketing.com/2013/05/dont-start-up-your-new-business-underfunded/

Contingency reserve

- "…. the amount of funds, budget, or time needed above the estimate to reduce the risk of overruns of project objectives to a level acceptable to the organization" [PMI 2004, p. 355].

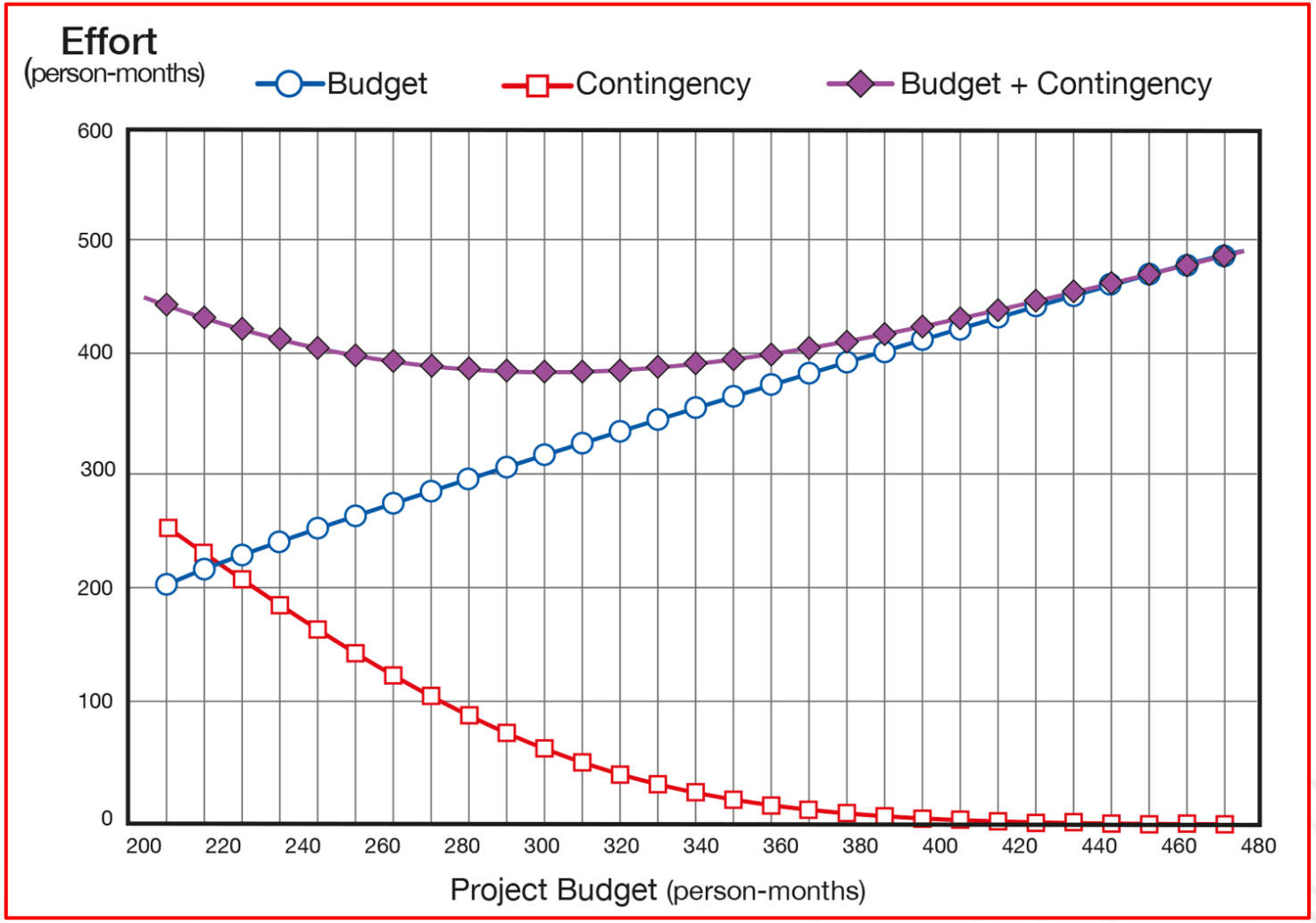
- Contingencies are added to projects using heuristics such as 10% or 20% of the project budget.

  - Monte Carlo simulations are used in more mature organizations.

http://alwaysimages.it/i/choosing/

3.4 A Contingency Example for a Single Project

Breakdown of total project costs



3.5 Managing Contingency Funds at the Portfolio Level

Budget allocation per scenario

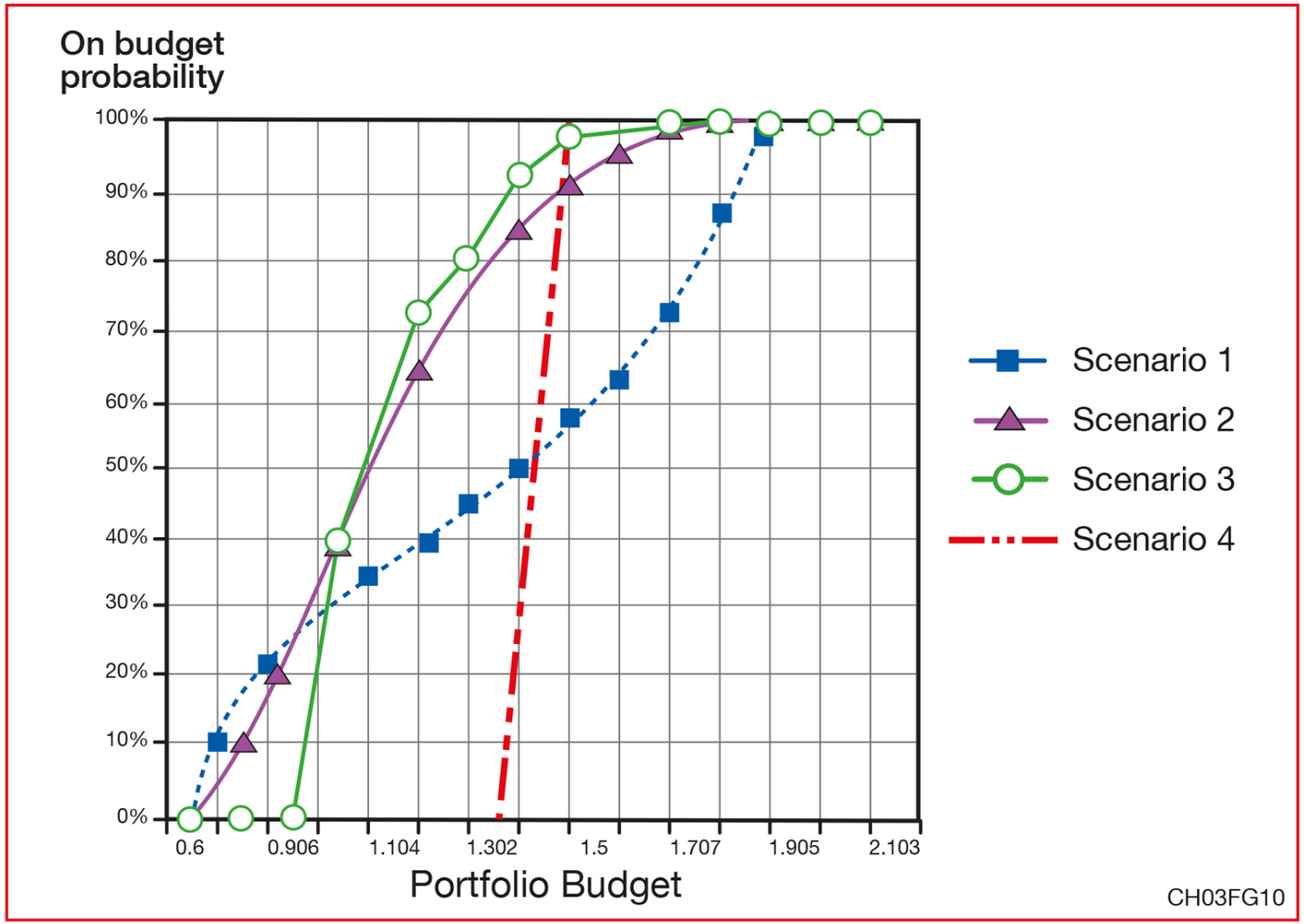
Scenario 1: Projects are allocated a budget equal to that of the best-case scenario

Scenario 2: A budget allocation equal to that of the most likely scenario.

Scenario 3: Budget allocation that minimizes the expected contingency.

Scenario 4: The budget allocation is set at the worst-case scenario.

Distribution of portfolio cost for each scenario

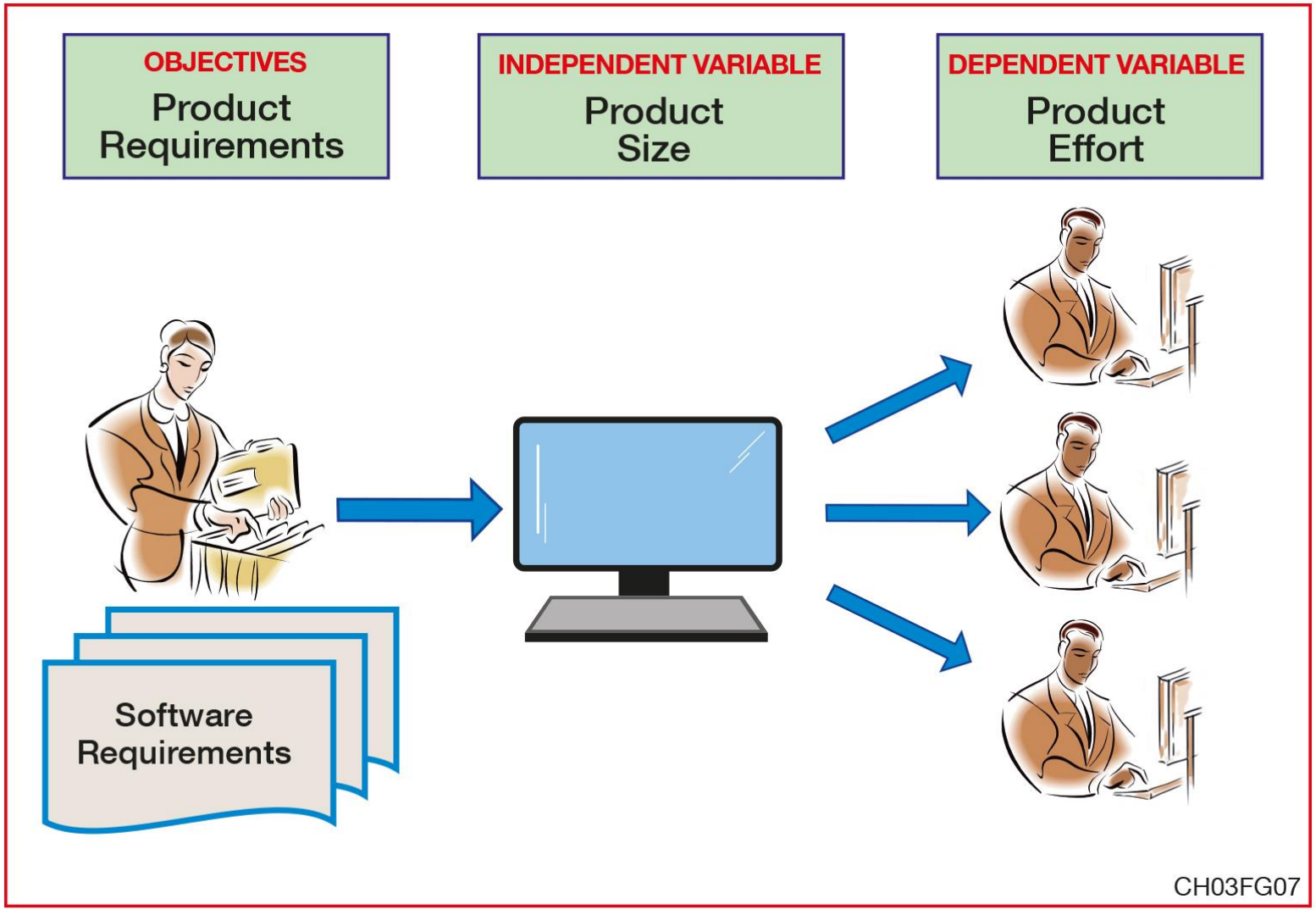


3.6 Managerial Prerogatives: An Example in the Agile Context

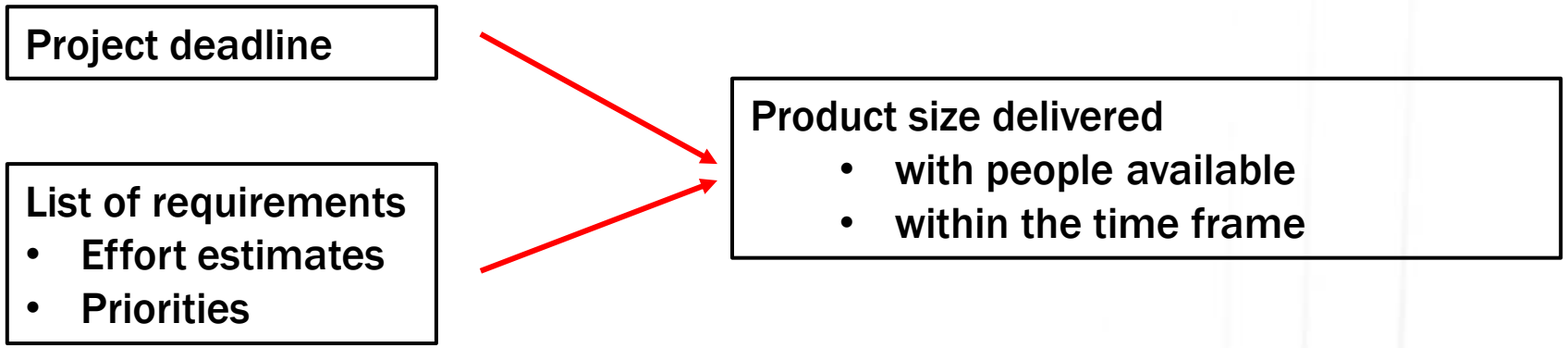
Product requirements drive product size.

Product size drives project effort.

Effort driver = Product size



Agile approach (simplified view)



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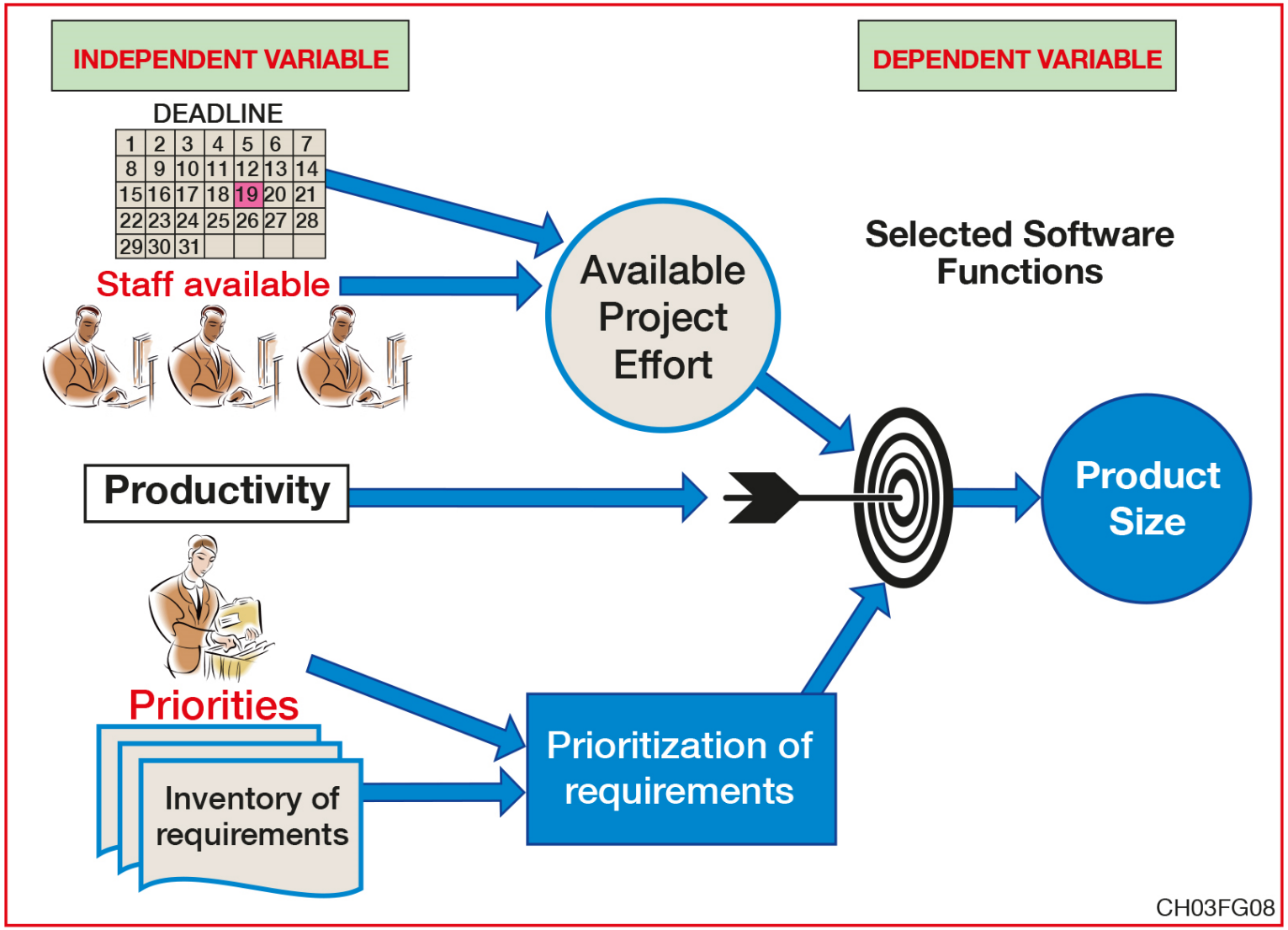
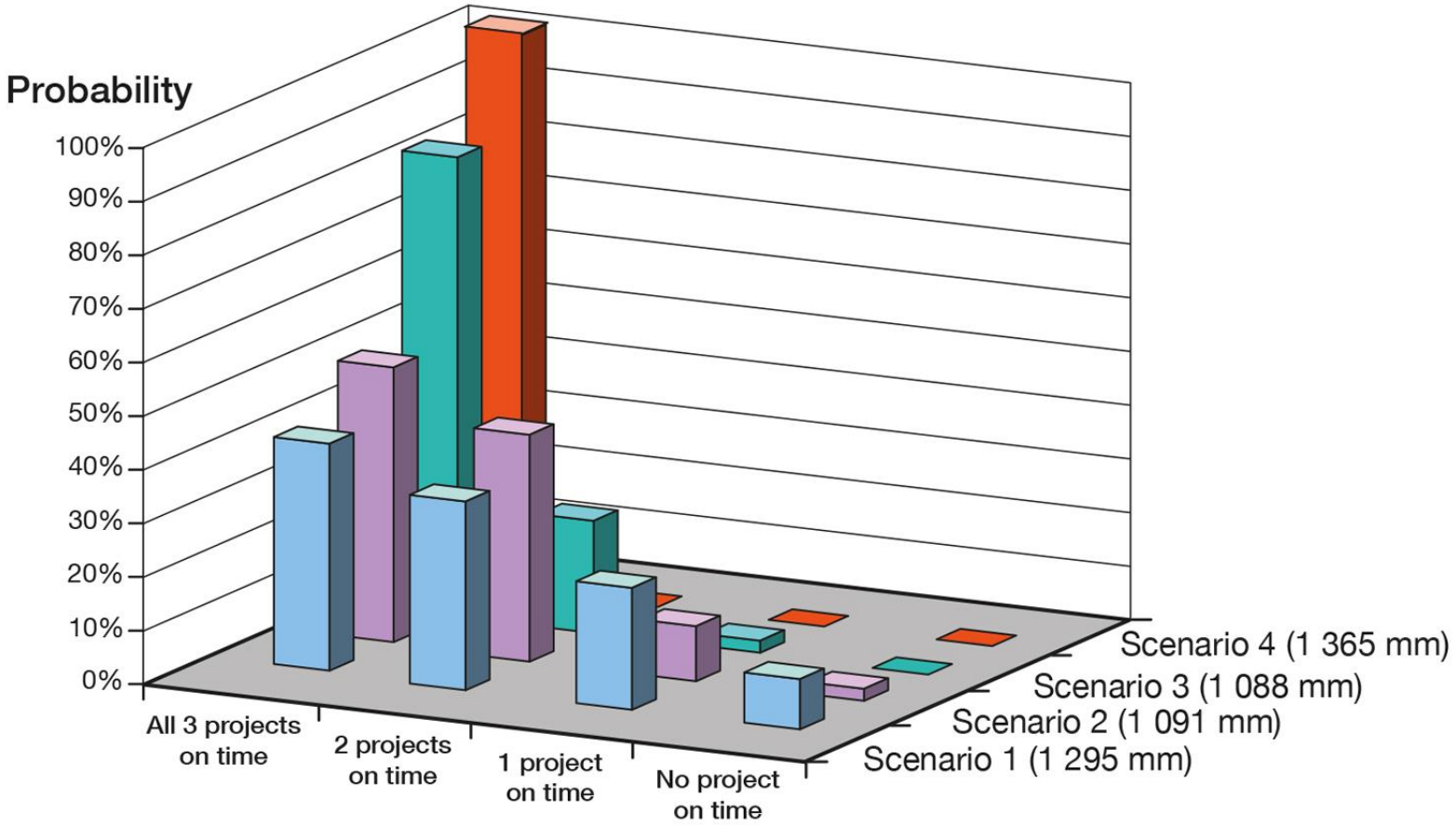
Project duration = Priority 1



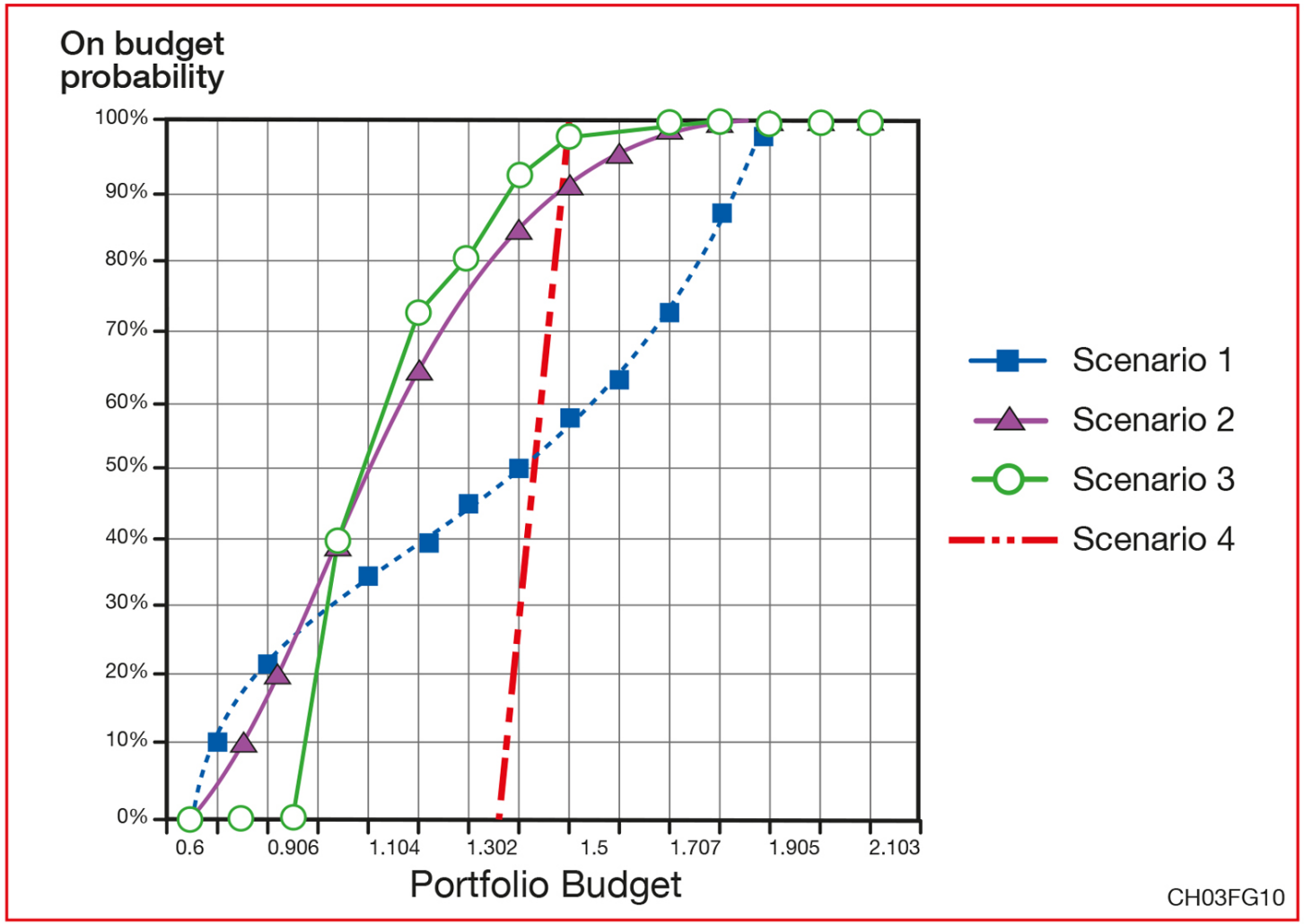
Further reading .....

Probability of delivering on time under different budget allocation scenarios



Note - The numbers between parentheses show the expected portfolio cost.

Distribution of portfolio cost for each scenario



Exercises

1. In Figure 3.1, what is the best-case and worst-case effort for a project with a functional size of 50 Function Points?
2. What is usually the probability that the most likely scenario will be successful in project management? Why?
3. If the size of the software to be developed in not precisely known at estimation time, but an expected size range can be identified, what is the impact of this on the estimation outcome?
4. What are the risks of selecting an optimistic scenario in software estimation? Who is responsible for mitigating risk when an optimistic scenario has been selected?

Exercises

5. Is the probability of underestimation the same across all scenarios (best case – most likely case – worst case)? What is the impact of underestimation on the contingency reserve?

6. What is the MAIMS behavior in project management?

7. Identify some of the biases in the business decision step when allocating a budget to a project. For each of these biases, what is the impact on the project manager and on the project team members?

8. In the example presented in Figure 3.6, what are the conditions for the minimum total project effort?

9. In a well run software organization, at what management level is the contingency fund handled?

10. The development of scenarios and the assignment of probabilities to budget values should involve the analysis of past data. Identify from Figures 1.12 to 1.16 the necessary data repositories and feedback loops that should be taken into account.

Term Assignments:

1. If in your organization you develop project budget scenarios (best case, most likely case, and worst case), what is the process for doing so? Is it mostly based on opinion, or on analysis of past projects?
2. Knowing your organization's experience in meeting effort and schedule estimates, what is the (true) probability that the most likely scenario will be achieved?
3. For the current project you are working on, what are the best-case, most likely, and worst-case scenarios? What probability of achieving each one would you currently assign to these scenarios?

Term Assignments

4. For the above project, for which you have identified various scenarios & corresponding probabilities, calculate what contingency amount should be held to fund a backup solution?

5. In your organization, who determines the amount of the contingency funds, &d who manages them?

6. You, in the project management (PM) office, are responsible for monitoring a number of projects. Identify for each project its probability of underestimation, & calculate the contingency funds that should be available to provide additional funding in a timely manner.