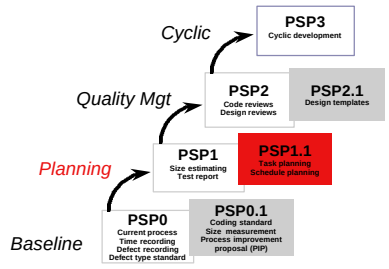
Planning IV: Resource & Schedule Estimating

Outline

- *Review of PSP Levels*
- *Overview*
- *Resource planning*
- *Estimating development and task time*
- *Combining multiple estimates*
- *Multiple regression*
- *Schedule estimating*
- *Earned value tracking*
- *Estimating accuracy*
- *Homework #5*

Review of PSP Levels *(Humphrey, 1995, p. 11)*

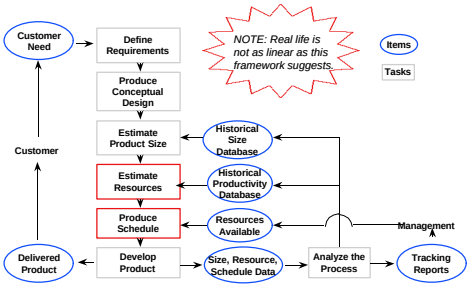


Overview *(cf. Humphrey, 1995, p. 145)*

- *This chapter covers:*
  - *How to make plans for small programs*
  - *How to combine these into larger consolidated plans*
- *Schedule planning includes:*
  - *Resource loading*
  - *Resource utilization*
  - *Earned value tracking*
  - *…*

Review of the PSP Project Planning Framework

(cf. Humphrey, 1995, p. 146)



Resource Planning *(cf. Humphrey, 1995, p. 145-147)*

- *In the PSP, the resource is your time.*
- *Productivity*
  - *Hours required / unit of work*
  - *Each job has many unique conditions and factors which affect productivity*
    - *See "cement" example, p. 148.*
  - *Estimate productivity by calculating the average and range from prior jobs (homework assignments)*

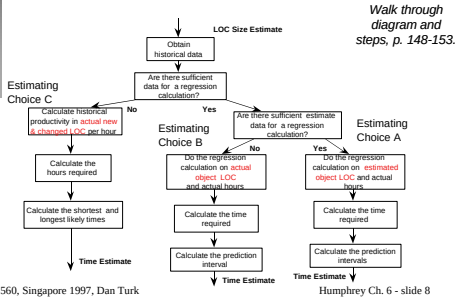
Estimating Task Time

(cf. Humphrey, 1995, p. 145)

- *The SW development task is a special instance of general tasks for which time estimates must be made.*
  - *See Fig. 6.3, p. 156, and general task-estimation steps.*
- *For SW development we prefer to base our estimates on historical data.*
- *We have three types of historical data which may be used:*
  - *A: Estimated object LOC & total actual development hours*
  - *B: Actual object LOC & total actual development hours*
  - *C: Actual total new/changed LOC & total actual development hours*

Development Time Planning Process *(Humphrey, 1995, p. 149)*

Walk through diagram and steps, p. 148-153.



Development Time Planning Example *(Humphrey, 1995, p. 149)*

- *Walk through example on p. 153-155*
- *See how regression parameters are calculated and used.*

Combining Multiple Estimates

(cf. Humphrey, 1995, p. 158-163)

- *Assume 4 estimates: a, b, c, d.*
- *The estimated hours and standard deviations are:*
  - H_a, H_b, H_c, H_d and s_a, s_b, s_c, s_d
- *When estimates are independent (e.g. come from separate databases) and unbiased (not all from same project, under same manager, etc.):*
  - H_t = total hourly time = ΣH_i
  - s_t = total standard deviation = $sqrt(\Sigma s_i^2)$
  - $H_{upper} = H_t + s_t$
  - $H_{lower} = H_t - s_t$

Combining Multiple Estimates Under Dependence *(cf. Humphrey, 1995, p. 158-163)*

- *Must use more involved calculation for the prediction interval when estimates to be combined are not statistically independent*
- *Use formulas on p. 160-162*

Multiple Regression

(cf. Humphrey, 1995, p. 162-166)

- *The problem:*
  - *We don't have detailed enough data.*
  - *e.g. We have total hours, new LOC, reused LOC, & modified LOC, but not hours by each of these LOC categories.*
- *The solution:*
  - *Multiple regression estimates the relative contributions.*
- *Example regression equation:*
  - $Hours_t = b_o + b_1 New_k + b_2 Reuse_k + b_3 Modified_k$

Multiple Regression (cont.)

(cf. Humphrey, 1995, p. 162-168)

- Gauss's method is used to solve the simultaneous equations (cf. p. 560-564 for an example).
- The resulting equation is:
  - Hours = 6.71 + 0.0784*650 + 0.0150*3000 + 0.2461*155 = 141
  - b_0 = 6.71 hours overhead
  - b_1 = 0.0784 hrs to develop a new LOC (12.76 LOC / hr)
  - b_2 = 0.0150 hrs to reuse a LOC (66.48 LOC / hr)
  - b_3 = 0.2461 hrs to modify a LOC 4.06 LOC / hr)
- The prediction interval calculation and formulas are shown on p. 166-168.
- Caution: Use regression with care. Don't apply formula outside database limits.

Schedule Estimating: Overview

(cf. Humphrey, 1995, p. 168-170)

- Even with good estimates, if you make incorrect assumptions about daily / weekly available time, schedules can be seriously in error.
- Only time available for direct work can be used to set a schedule.
- Many other activities demand your time: vacation, sick, mail, committees, etc.
- Over time you should gather data on how you use your time, only then can you make good schedules.
  - Planning using this "unplanned time cushion" gives you some "slack" and room for adjustment for "crunch" times in your schedule.
- Typically only 50-75% of time can be spent on direct work.

Schedule Estimating: The PSP Schedule Planning Procedure

(cf. Humphrey, 1995, p. 170-180)

- The procedure is documented by:
  - Fig 6.4: PSP Schedule Planning Diagram
  - Table 6.11 & 12: Schedule Planning Template & Example
  - Table 6.13 & 14: Task Planning Template & Example
- NOTE:
  - This is presented in a very TOP-DOWN approach, as opposed to a BOTTOM-UP approach which is commonly used in activity-based planning (cf. MGT 882).
- Look at and talk about Fig. 6.4, p. 171
- Walk through step-by-step sequence, & forms
- Discuss relationship of this method to project networks, activity-based planning, etc.
  - Show equivalent network for Humphrey's task plan
  - Demonstrate project management software.

Earned Value: Definition

(cf. Humphrey, 1995, p. 180-182)

- "Earned value (EV) is a way to evaluate project progress. It establishes a relative value for every task and credits that value when [the task is complete]."
- EV allows progress to be tracked on different types of activities, and even when planned sequencing is changed, or tasks are added or deleted.
- EV = Percent based on proportion of total project.

Earned Value (cont.)

(cf. Humphrey, 1995, p. 180-182)

- EV is credited only when a task is completed.
  - No partial credit is given.
  - If tasks are large enough that intermediate tracking is desired, break them down and assign EV's to all sub-tasks.
- Question: What are some examples of small and large ISD/SE tasks?
- Set checkpoints based on total project size.
  - Over 2-3 weeks, 10 checks is too much
  - Humphrey:
    > 1 per week, < 1 per day
    2-4 per week

EV Tracking Example

(cf. Humphrey, 1995, p. 182-195)

- Walk through:
  - Tables 6.15 & 16 - Task & Schedule Plans
  - Tables 6.17 & 18 - Actual
  - Table 6.19 - Adjusted schedule (additional task added to original schedule)
- Finished on time even with all the changes.

EV Conclusions

(cf. Humphrey, 1995, p. 195-196)

- Get management help for problems and alert them to changes.
- EV & motivation
  - It is hard to maintain motivation when working on activities which have no EV.
  - Therefore, promptly put new activities into your plan, and
  - Promptly drop activities.
  - Remember, you are in charge, and the plan is there to help you.

Estimating Accuracy

(cf. Humphrey, 1995, p. 196-204)

- Estimation is difficult.
- Over- and under-estimation should balance out.
- Error% = 100 * (Act - Est) / Est
- Note student and class results in Fig's 6.6-13 on p. 197-201.
  - Over- and under-estimation
  - Improvement for some
  - Bad estimate after good ones.
  - …
- DON'T OVERCOMPENSATE
- Learning time depends on each person

Estimating Accuracy (cont.)

(cf. Humphrey, 1995, p. 202-204)

- Small estimates
  - Small tasks have lots of variation.
  - To improve estimation, try to understand as many causes as possible.
  - Do this with consistent planning, using historical data, and planning in detail.
- Composite estimates
  - Composites are more reliable
  - Estimates are difficult when using evolving process data

Estimating Accuracy (cont.)

(cf. Humphrey, 1995, p. 202-204)

- Overcompensation
  - Don't estimate to "average" - you'll always be off
  - Don't adjust your intuition
  - Get feedback from colleagues
- Reasonableness
  - Is the estimate reasonable?
  - Strange b weights can be caused by:
    - Closely-clustered historical data
    - Estimating above and below the historical data range
    - Including outliers

Homework #5

- See "Homework Assignments" list and textbook instructions.