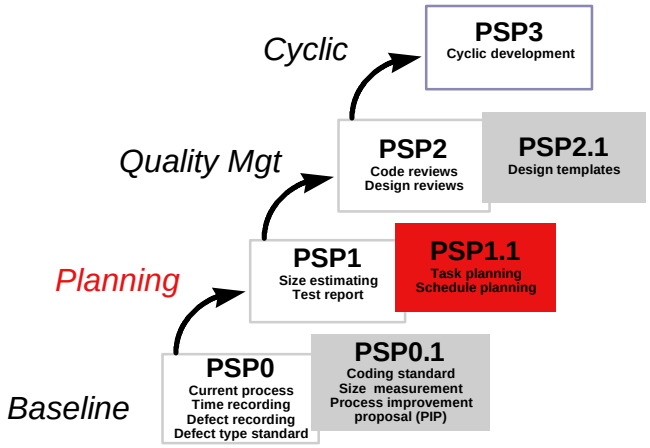
Planning IV: Resource & Schedule Estimating

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)*

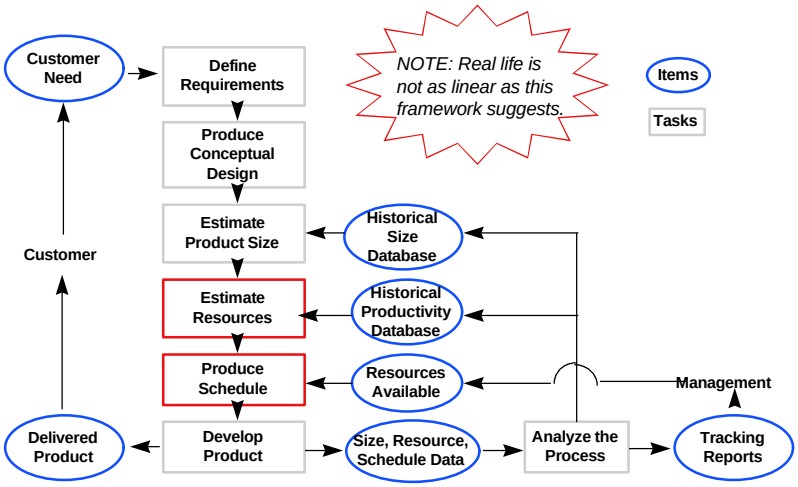


Overview *(cf. Humphrey, 1995, p. 145)*

- *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)*

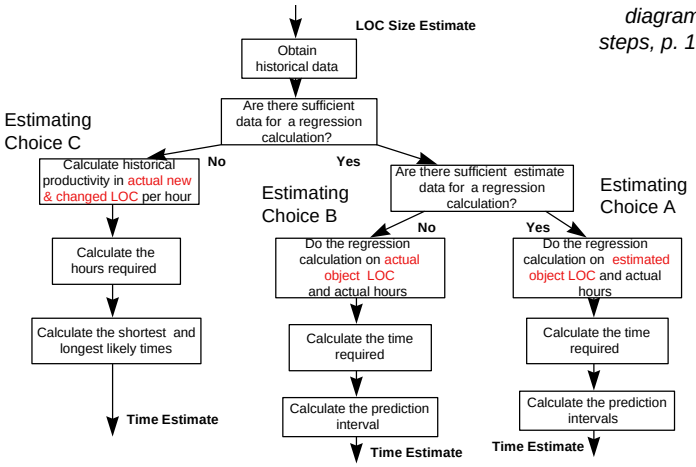
Estimating Task Time

(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 = $S H_i$
  - s_t = total standard deviation = sqrt($S s_i$)
  - $H_{upper} = H_t + s_t$
  - $H_{lower} = H_t - s_t$

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_o = 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<u>total</u> 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

- *Program 5A*
  - *Integration via Simpson's rule*
  - *See p. 755-757, and Assignment Kit #5*