Week 6 - Project dynamics in ISDM

I. Conceptualizing a model of a project
   A. Stages in problem definition and conceptualization
      * Problem focus
      * Problem dynamics
      * Context
      * Audience
      * Model purposes
   B. Model boundaries
      Temporal - what's the time horizon?
      Conceptual - what's included and what's excluded?
      Causal - what's endogenous and what's exogenous?
   C. Aggregation
   D. Reference modes
   E. Initial policy options
   F. Model sectors
      Important processes in each sector
      Important levels and associated rates in each process
   G. Important processes in each sector

B. Problem focus
   1. Project overruns in cost, people, and time

C. Problem dynamics
   1. Graph of cost overrun
   2. Graph of overrun in personnel
   3. Graph of schedule overrun

D. Context
   1. Imagine a client with lots of experience in cost overruns in R&D projects
   2. Data on overruns available

E. Audience
   1. Project managers; administrators and staff in an R&D group

F. Model purposes
   1. Policy analysis to minimize overruns
   2. Ongoing guide for project management
   3. Teaching modeling

G. Model boundaries
   1. Temporal
      a) Life of the project -- assume about 4 years (48 months)
   2. Conceptual
      a) Included
      (1) Workforce planning
      (2) Making and reporting progress
      (3) Scheduling
      b) Excluded
3. Causal
   a) Endogenous
      (1) Workforce planning, hiring, and quits
      (2) Making and reporting progress
      (3) Schedule changes from schedule pressure
   b) Exogenous
      (1) Project definition
      (2) Tendency to make errors (assumed constant)

H. Aggregation
I. Reference modes
J. Model sectors
K. Important processes in each sector
L. Important levels and rates in each process and/or sector
M. Apparently important feedback loops

II. Formulating a project model - a sector view
   A. Workforce sector
      1. Workforce; hiring policy
   B. Progress sector
      1. Making and monitoring progress
   C. Scheduling sector
      1. Setting the schedule; perceiving and acting on the need to change the scheduled completion date

III. Project model without rework
   A. Project 1a: A concept model.
      1. Develop main workforce-progress-effort remaining-hiring loop with class.
      2. Provide schedule loop.
3.

4. Go through equations in detail.

B. Project 1b: Accurate perceived productivity.
   1. Elicit process for monitoring productivity (cum progress / cum effort).
   2. Go through new equations in detail.
   3. Note the technical necessity to set the initial value of Cumulative Progress to a tiny positive number to prevent division by zero in Perceived Productivity.

   a) Note that such a technical fix usually means that we have formulated something that could not be done exactly that way in the real system. Here we have formulated a method of monitoring productivity that people evidently could not do at the beginning of a project. So they must be getting their early estimates of productivity some other way (guessing?) and then gradually moving to this monitoring method as the project develops. But we’re ignoring that transition for the moment.
IV. Project 1c: Addition of undiscovered rework -- a dynamic hypothesis for overruns
A. Introduce the concept of a dynamic hypothesis
B. Elicit from class potential reasons for overruns.
C. Settle on Undiscovered Rework as the one to develop.
D. Provide the following structure. Be sure they can write the new equations, especially Time to Discover Rework.
E.

F. Simulate this model (Project 1c).
   1. Note sharp increases in Workforce near the end.
   2. Motivate Willingness to Change Workforce.

G. Project 1d: including Willingness to Change Workforce

H.

1. Simulate. Note we have reproduced the reference behavior mode.
2. Change FSAT

I. Conclusions at this point
   1. Undiscovered rework can generate project overruns.
2. “50% of the time 90% done”
3. Model is not very policy rich at this point
4. Model has flaw in Time to Detect Rework: No people are required!

J. Project 1e: Leading to realistic formulation of Detection of Rework, with structure left for students to fill in:
1. Motivate by noting that the model does not stand up to an obvious extreme condition test: If the Workforce is set to zero at some point in the middle of a simulation, Rework would continue to be Discovered, even though there are no people around to do that.
2. Elicit class suggestions for fixing this -- have them focus on what would really be happening in a project, and let this lead to separating the workforce into the two circled groups below.
3. Note those two subsets are not formulated as stocks, but as populations computed as fractions of a stock.

V. Homework overview
A. The task: reformulate detection of rework
B. The steps
1. Change model (Project 1d) to diagram (Project 1e) -- initially make the policy parameter constant
2. Make Testing Productivity a function of Undiscovered Rework. In the assignment they should discover why this is necessary.
3. Make Fraction of Workforce in Testing a function of something in the model that real actors in the real system (project managers) would use to indicate how much effort to put into testing rather than progress on the project.
a) Again, experiments with the model in the assignment should indicate that there are problems with a constant fraction of the workforce in testing.

b) The best formulations here will capture what real people could and would do to set the fraction of workforce in testing.

4. Hand in documentation (figures, table functions) and representative runs, with commentary.