ESD.36 System Project Management **Fall 2003**
System Design and Management Program (SDM)
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Homework 6
Out: October 30, 2003
System Dynamics 2: Strategic Project Planning and Execution
Due: November 13, 2003, 3pm

Learning Objectives
In this homework you will use a system dynamics model of a project to analyze strategic issues in staffing, scheduling, and time allocation. You will explore tradeoffs between short-term benefits of charging ahead with work, versus longer-term benefits of avoiding errors. *Excluding any Vensim output, 2-3 pages of text are sufficient to answer this assignment; brevity and clarity are a plus. Only include Vensim output where it is necessary to make your points.*

Resources
1. Vensim PLE – download from www.vensim.com (free)
2. Capstone Past Project.mdl – download from server

Assignment

You have been promoted to project manager of the Capstone Project. The Capstone Project is intended to radically improve the ease of maintenance, enhancement, and upgrade of an existing product, via a complete redesign of the internal workings of the product using the latest technology. As far as customer interfaces, however, the product will maintain the same look and feel as the existing product.

As this project is critical to you future career, you have engaged a consultant to assist you in adapting a system dynamics model to your project. The consultants have modeled the development effort for the existing product, and calibrated it to data for that project. They have delivered the model of the past project to you as Capstone Past Project.mdl.

The Past Project was less than a stellar success. The original plan called for completion in 30 months at a cost of 115 person-months of effort. The actual project took nearly 39 months, and cost 265 person-months! You don't need that kind of performance to enhance your career. You have discussed the past project with those involved, and concluded that while the technology on that project was well understood by the development team, the project suffered significant rework discovered late in the project because the development team did not really understand what the customer wanted. As a result, much of the early design needed to be redone. You're fairly certain that your project will not suffer that fate, as the look and feel will remain the same. However, you are concerned about the technical side of this development. This is a complex project with a technology that is new for your team, involving both new concepts and new parts and materials. You expect that they will make mistakes as they learn, and these mistakes will likely persist throughout the project. You've asked your consultant to look at the data for prior

projects with similar technical risk, and he's concluded that on average these projects suffered a 15% error rate from technology risk, though the range was 5-25% (this is on top of the normal 5% error rate – i.e., quality degradation – from miscellaneous causes on a typical project).

Your engineers expect that the number of tasks required to complete this project is about the same as the Past Project, and that normal productivity should be about the same.

Part 1 (20 points)

Your boss thinks that given the same work scope as the Past Project, and that the same mistakes will not be repeated on this project, the budget for your project should be 115 person-months with a 30 month schedule, and that 4 staff is all you will need to get the job done (these assumptions are included in the Capstone Model). What do you think? Adapt the Capstone Past Project model to reflect the new project, and develop a cost estimate for your boss:

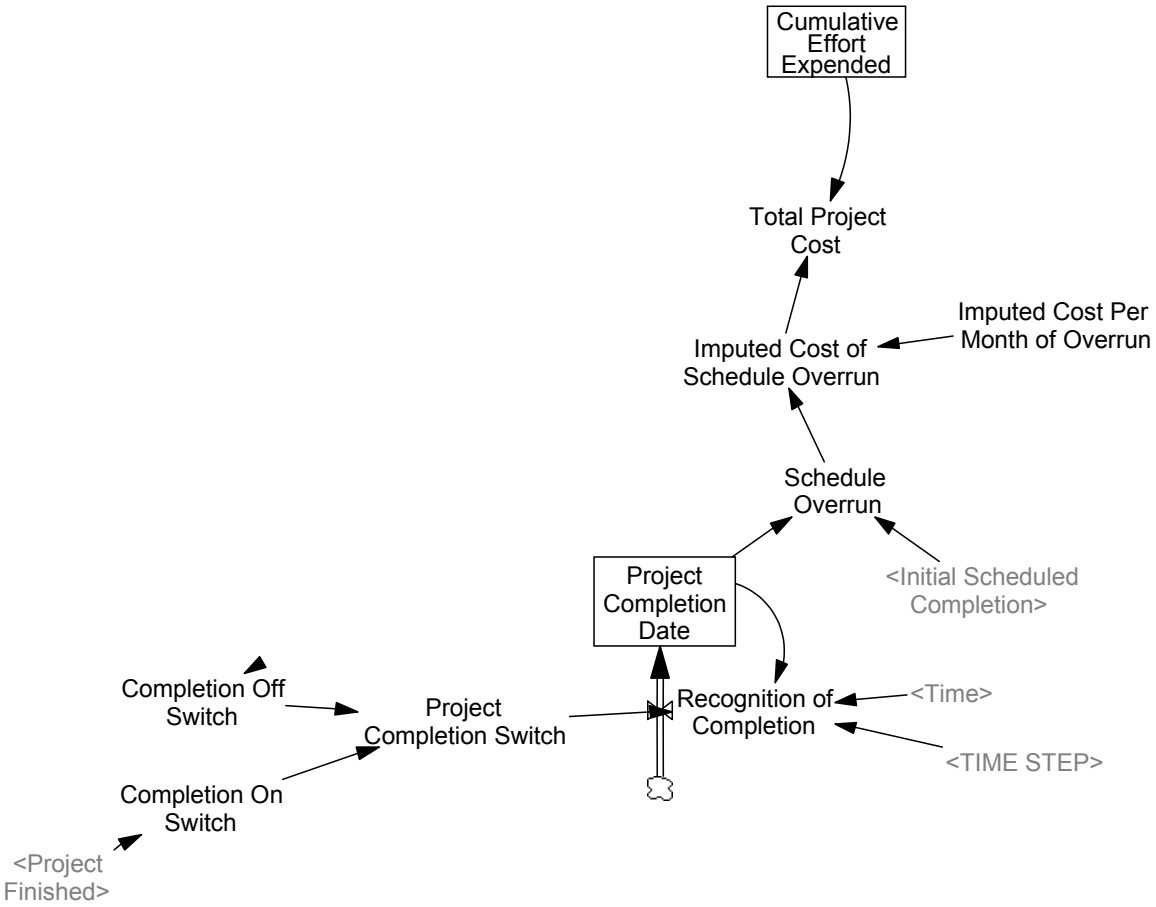
1. List the changes that you made to reflect the new project [only 3 parameter changes are required – switch for uncertain customer requirements (turn it off); normal quality (adjust to reflect technical uncertainty); and willingness to hire (adjust to reflect bosses policy)]
2. Simulate the model and thereby estimate the cost (cumulative effort expended) and completion date of the project with these changes
3. Explain to your boss how a 15 percentage point increase in technical error rate (or a 15 percentage point decrease in normal quality) increases the cost of the project by approximately 100 percent (or whatever you concluded), and delays the project significantly

Part 2 (40 points)

Your numbers and explanation have convinced your boss that his plan may be optimistic. Nevertheless, he wants to start the project with those assumptions. He has agreed, however, to consider adding people and/or slipping the schedule if things do not turn out as he expects. Assuming your estimate of project parameters turns out to be accurate, what mix of hiring and schedule slip would you recommend to your boss?

The relevant parameters to change are Willingness to Hire and Willingness to Slip. Although it is not essential, logically willingness to hire and willingness to slip should add to 1.0. In order to quantify the cost of the project being late, several equations have been added to the model (lower right quadrant) as shown below. Total Project Cost sums cumulative effort expended by staff to accomplish the work ("direct cost") and an imputed cost of schedule overrun. For every month the project is late, an imputed cost of 10 person-months per month is charged. This cost was estimated using a sophisticated system dynamics market model combined with discounted cash flow and real options pricing, so it is highly accurate. For this question:

1. Provide a table summarizing the simulations you made, project completion date, direct cost, imputed cost, and total cost (approximately 5-6 simulations – no additional simulations are required for the questions below).
2. Provide a graph of staff level for the simulations.
3. Discuss the tradeoffs between direct cost and imputed cost; describe to your boss why direct cost behaves as observed. Use a couple of Vensim output graphs.
4. Which hiring/schedule policy would you recommend, and why?



Part 3 (40 points)

Your boss has agreed to your recommendation. However, you think that you can do better by having staff allocate 10% of their time to reviewing and checking the work of others after each task is done. You estimate that this can reduce the maximum rework discovery time to 6 months.

1. What two parameter changes did you make to test this policy and why?
2. Does this improve the performance of the project? ***Why***?
3. You are not very certain about the ***benefits*** of this review process. Conduct a few additional simulation experiments to test the sensitivity of your assumption regarding the direct benefit of spending time on review (assume that your estimate of technical uncertainty is correct). ***Summarize your conclusions.***
4. Your boss argues that this will slow progress. ***Is he right that, using standard progress estimates, the project is making less progress than before? Are these estimates accurate measures of real progress?***