Fighting the Physics of Human Nature: Acceleration Mental Model Effects on Project Schedule and Cost Performance

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Abstract – Significant project and program schedule and cost overruns occur too frequently. This paper (in the Supporting Material section) uses Systems Thinking aided by Simulation (STim) to explore how our typical mental models and mindsets can lead us to accelerate projects to the degree that, paradoxically, the program finishes later and costs more than it would have in the absence of the acceleration. It explains a real-world "quality" feedback loop that our typical mental models often discount or ignore. If this quality loop were more often and deeply embedded within our mental models we would be more cautious when planning to accelerate projects and programs. Computer simulation contrasts anticipated project schedule and cost performance dynamics arising from decisions based on both typical and improved mental models. This project acceleration insight arises from one extreme of the continuum of STim practice. Program management examples illustrate the other end of the continuum. The STim process is described, including how the STim process not only tests policies, but also provides an explicit approach for identifying policies that can improve system performance.

Extended Abstract – This extended abstract, which was presented at the conference, focuses on two methodological aspects of the paper:

1) Use of the acronym "STim (<u>S</u>ystems <u>T</u>hinking aided by <u>Sim</u>ulation)" instead of "system dynamics"
2) Use of a modified five-layer systems thinking iceberg not only as the usual metaphor for systems thinking and STim, but also as a basis for a modeling process that provides an explicit approach to both:
    a. communicating system structure and behavior, and
    b. identifying policies that can improve system performance

"STim" means the same thing as "system dynamics." STim is a useful acronym in organizations or communities in which "systems thinking" has become meaningful to a significant number of people in those organizations or communities. When exposed to the simulation aspects of system dynamics, people who are familiar with, and believe they understand, what systems thinking is, often ask questions something like, "Are we doing systems thinking now, or system dynamics?" and get into useless debates over the differences between the two. In organizations and communities which have been introduced to "systems thinking," use of the STim acronym in place of "system dynamics," though it means the same thing as "system

dynamics," reduces the incidence of such questions and useless debates that distract from the problem of concern.

The classical systems thinking iceberg consists of four layers: events (above the waterline), patterns over time (just below the waterline), system structure (next down), and mental models (the deepest layer). There is an extensive literature on the deepest mental models layer; however, for the pragmatic purposes of applying STim, two simple definitions of "model" and "mental model" from Merritt (2010a and 2010b), are useful:

> Model: "an abstraction or simplification of a system"

> Mental model: "a model that is constructed & simulated within a conscious mind."

Thus, using these definitions, a mental model is a model; that is, it is a representation of system structure. Practitioners of systems thinking often leave their audiences with a much fuzzier sense of what a mental model is – as something perhaps inclusive of one's understanding of system structure, but much broader. A five layer iceberg that adds a fifth "mindsets" layer beneath the "mental models" layer clarifies the distinction between one's understanding of system structure (their "mental model") and other fuzzier concepts that many systems thinking practitioners have been classifying as aspects of one's mental model.

Adding this fifth layer to the iceberg means the middle three layers of the revised iceberg consist of the upper "patterns over time" layer, the middle "system structure" layer, and the lower "mental models" layer (also representing perceptions of system structure). These three layers are sufficient to:

A. create an explicit approach for discovering policies that will improve system performance
B. simplify the communication of important system structure

Relative to A, classical system dynamics modeling processes such as described in Sterman (2000), Ch. 3, Saeed (1998, Fig 1) and Randers (1976, Fig 13) offer a way to test proposed policies, but do not offer an explicit approach for identifying polices that can improve system performance. Hence A offers the possibility of a useful improvement in system dynamics (or STim) practice.

Relative to B, for communication purposes, it can be sufficient to describe only a plausible current mental model (system structure) capable of causing the dynamic problem of concern, as well as a plausible improved mental model (system structure) that could improve system performance. It may be unnecessary to describe any further system structure and dynamics, thus simplifying the presentation of insights from the system dynamics (STim) work.

The full paper provides a worked example of use of both the STim acronym and the modified five-layer STim iceberg for improving the communication of system structure and behavior and for identifying policies that can improve system performance.

References:

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