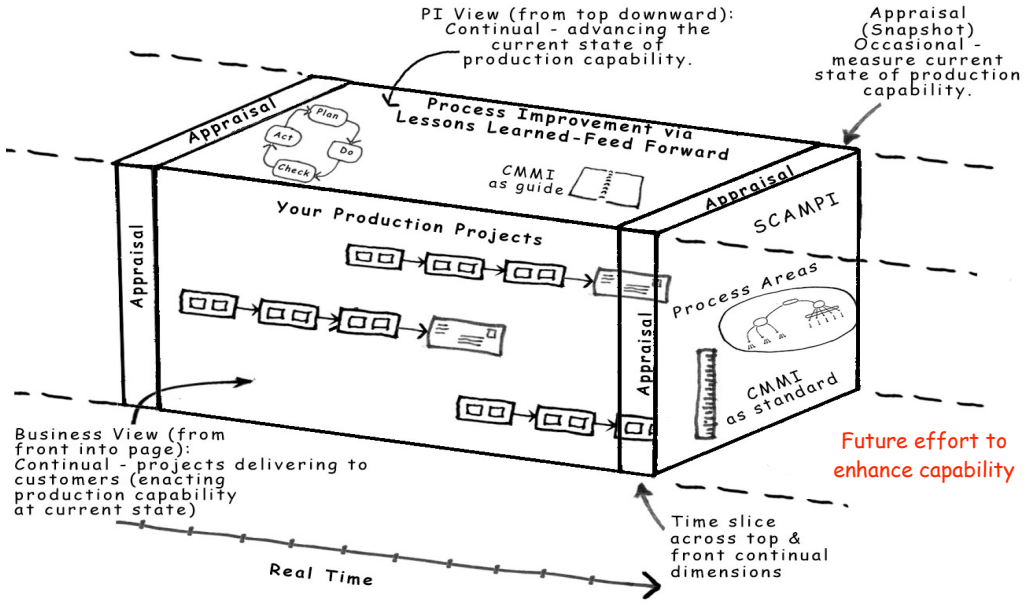
The Evolution Cube

To kick off "The Occasional Pictogram" here is Figure 8 and some accompanying text from *A Guide to the CMMI*® 2d edition, pp. 39-40.



Evolution cube v23

> "The structure of static PAs optimizes them for use in a benchmark appraisal, an occasional, if important, event. (See figure 8.) Appraisals, whether staged or continuous, are infrequent snapshots, but are often taken as the goal ("Level x by end of year"), whereas the aim should be enhancing production capability routinely. That is done by continual process improvement, often with CMMI as a guide, and necessarily if appraisals are part of your business model. The Process Area structure of CMMI, as opposed to the content, is not necessarily optimal as a guide for improvement. In a sense, using the model to prepare to "pass" an appraisal is like studying for the test. There is a difference between studying for the occasional test and streamlining tasks to make them ever more efficient, what the model means by process capability and maturity. The difference is in the possible side effects of the first approach: you can prepare for the test by trying to make your product process (a flow) look like the model (PA silos). I call this direct implementation of Process Areas the checklist approach, reducing the hundreds of practices to a huge checklist that projects are expected to conform to."

Figure 8 is to my mind one of the 3 most important pictograms in the book. (The other two are Figure 7, "Production Is a Flow, Process Areas Are Static", and Figure 10, "Lessons Learned and Feed Forward", both for future ToPs discussions.)

These three are the most important because they are about implementing CMMI practices, and the CMMI® has little in it about implementation, at least in the sense of the "big picture" of Fig. 8.

CMMI is often thought of along with SCAMPI℠, an appraisal to determine a company's maturity level. When I tried to picture a company that is following the CMMI (model-based improvement), Fig.8 came to mind. The pictogram shows the business view (front of the cube

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facing you) of a company with high-tech projects that periodically has an appraisal, the time slice across the end of the cube facing right. (Nowadays, and since August 2007, the period between appraisals is 3 years: SCAMPI results are valid for 3 years after the last day of the on-site period.)

But, appraisals (they used to be called "assessments") and capability maturity models® in general (what I call cmms – making the generic even more so) are only incidental to the main purpose of process improvement as originally conceived. That purpose is shown on the top surface of the cube: continual growth in delivery capacity. You can find the purpose stated in the founding document of systematic software process improvement, "Technical Report (TR) 23". [W. S. Humphrey, W. L. Sweet, et al. "A Method for Assessing the Software Engineering Capability of Contractors." Software Engineering Institute, SEI Technical Report CMU/SEI-87-TR-23, September 1987.] Watts Humphrey and his SEI colleagues recommended that evaluators of software companies should "…consider both current capability and future plans for software process improvement." Two things then: current capability and future effort to enhance capability.

And those two things lead to Fig. 8. By definition, current capability is measured by an appraisal, usually the benchmarking variety or SCAMPI "A". The appraisal is periodic, like a person's physical checkup, that shows either that we are healthy and should maintain the same state of health until next check-up, or that there are deficiencies to be remedied.

If we move from human health to high-tech organizations, we may notice something odd. In between appraisals, it's fairly common for some organizations to back-slide. (Maybe not so odd. A lot of us do the same thing between doctor checkups – a little more wine, a second dessert, skipping exercise). Those who hire a SCAMPI-appraised company expecting the exemplary behavior of its claimed maturity level may see nothing like it. Why? Can we find a cause of not acting your age, so to speak?

This ToP holds that the cause is focusing on appraisals, the end slices of Fig. 8, neglecting the top surface (continual improvement) and not suffusing it downward and through the business (front view) via Plan-Do-Check-Act and Lessons Learned – Feed Forward, to be discussed in a later ToP. In the back-slider case, the appraisal remains a sometime affair, gearing up (nowadays every 3 years) to show the "current capability" of TR-23 but missing entirely its sustainment, the "future effort to enhance capability."

Appraisals are not the context of actual project practice. We know from TR-23 that enhanced capability was what assessment measured along with "future plans for software process improvement", an early, pre-CMM and pre-CMMI version of what is now called "institutionalization".

The I-word, institutionalization, names a fuzzy concept, one that will be talked about in different ways in the first series of these ToP notes.

One way to look at the I-word concept is with Fig. 8, where institutionalization is pictured by the top surface of the 3-D rectangle. There the CMMI is the *generic* guide (one of many), Lessons Learned-Feed Forward (LLaFFing) is the *specific* guide and Plan-Do-Check-Act (PDCA), the generic mechanism, with production value (process improvement or "future effort to enhance capability") the business outcome. This outcome is 4-D: it is carried out through business deliveries (technical projects, shown on the outward face of the rectangle but which fill the space

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"into" and "down" the page) over all production cycles in real project time (the 4th dimension); the time dimension means that production value should be continuous.

I have seen two ways of implementing the top surface of Fig. 8. In one way, call it appraisal focused, effort is devoted to preparing for a SCAMPI, the appraisal slices at either end of the cube; the other, production focused, works downward in the cube to remove rework in projects, aiming at what you might call lean production. Both ways gear up for the occasional appraisal, but the production focus merely adds SCAMPI preparation at the appropriate time to a steady-state (institutionalized) program.

In either case, effort is required in addition to the project effort that goes strictly into delivery. Such effort is overhead, not funded by project customers; therefore it is pictured on top of the 4-D cube which stands for a business in the production space and time dimension of Fig. 8.

We can picture the two ways of investing overhead effort (the top surface of Fig. 8) in the next two images.

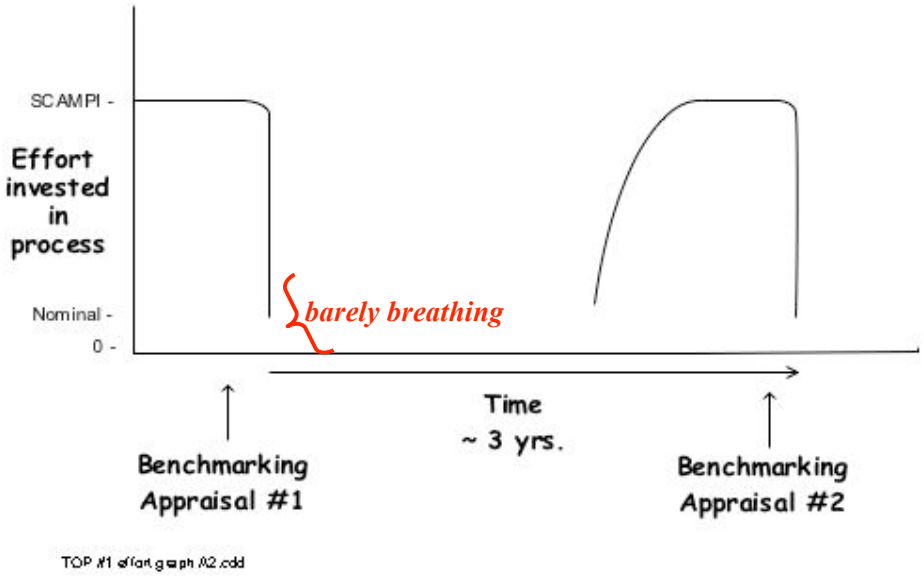

Figure ToP 1.1

Fig. ToP 1.1 shows the level of investment for an appraisal focus over about 4 years. The horizontal axis represents calendar time with two appraisals about 3 years apart. The vertical axis is level of investment in process improvement increasing upwards from zero, through some nominal (and probably ineffective) level, through an amount sufficient to prepare for a SCAMPI. For appraisal #1, the level of effort is shown at the SCAMPI-adequate amount, then falling to a nominal investment ("barely breathing") shortly after appraisal #1. For the better part of the next 3 years, the investment stays nominal until it ramps up rapidly to prepare for appraisal #2.

An exclusive focus on appraisals can starve capability improvement, which was the whole purpose of cmms and "assessments" from the beginning. The result for an organization would look like the "evolution cube" without its top dimension as in ToP Fig. 1.2 and little (i.e., nominal) effort in process capability between SCAMPIs. "Production continues but improvement lag" as in the lower right of the figure.

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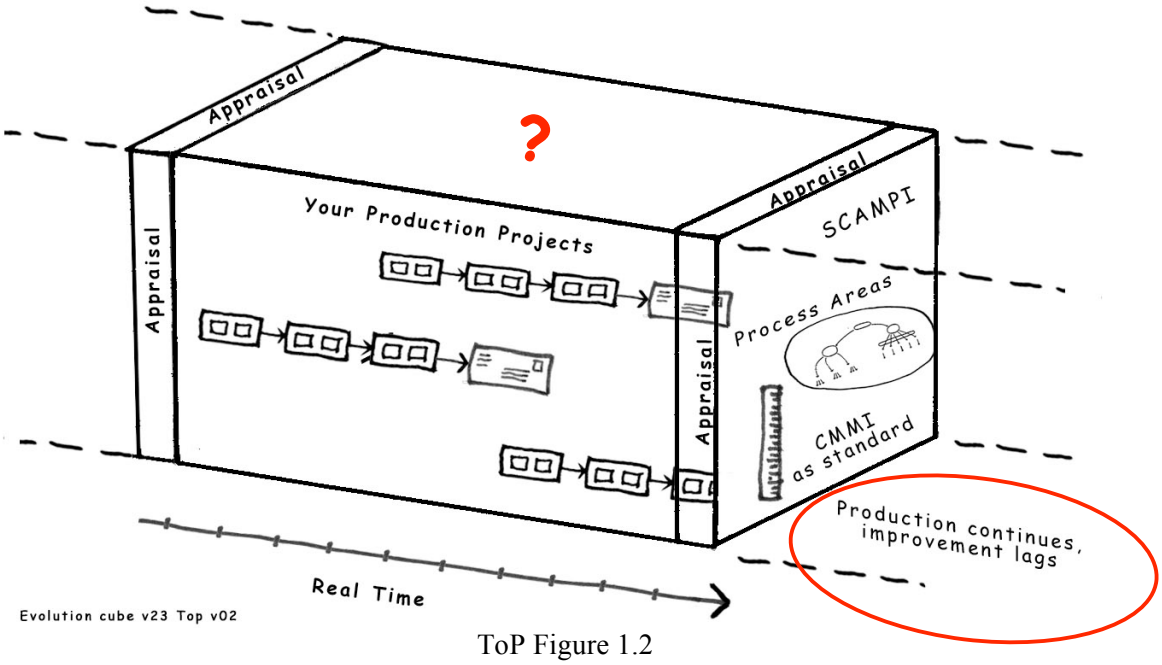
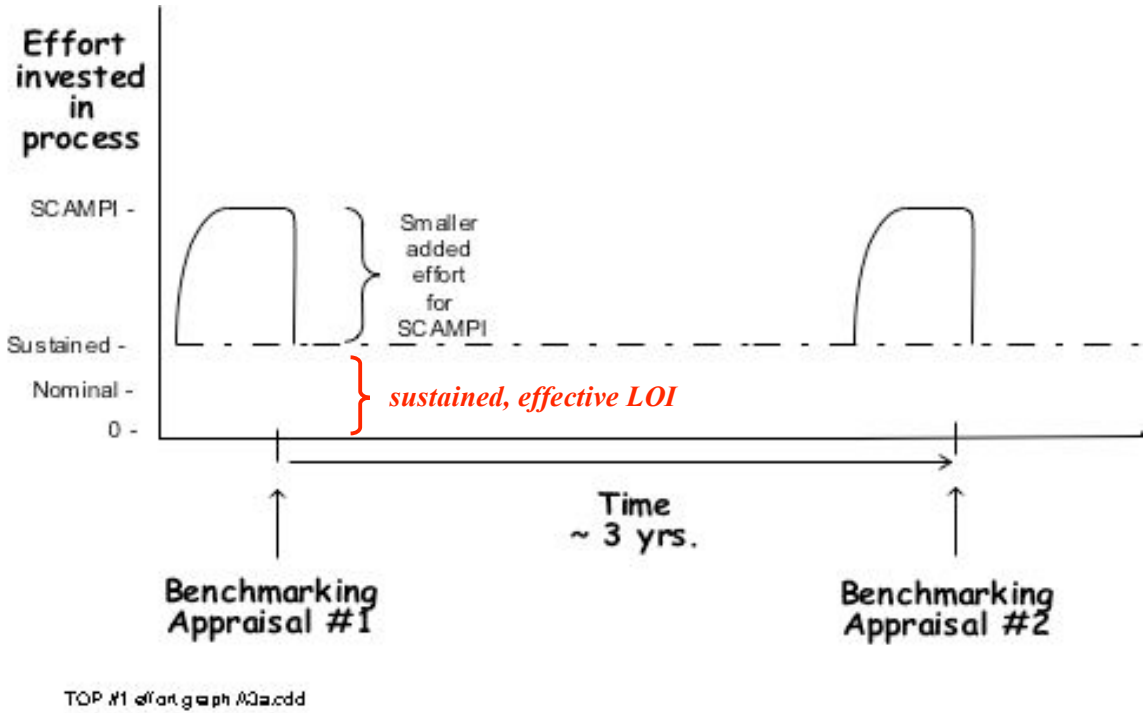


ToP Figure 1.2

Whereas what should happen according to TR-23, the 1987 founding document of process improvement, is something like the pattern of effort investment shown in ToP Fig. 1.3 below.



ToP Fig. 1.3

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In that diagram a sustained investment in SPI above the nominal level continues before, between, and after appraisals. There are no tic marks on the vertical axis since I can't attach verified numbers to the nominal or sustained levels nor to the SCAMPI peaks. However, in a later ToP, I'll discuss some numbers within ranges we have encountered and which seem reasonable.

So far I've argued that too much focus on appraisals can lead to missing out on capability improvement, an entire dimension of an organization's life and the whole point of appraisals from the beginning. What should happen is that the peak-period appraisal effort returns to a steady expenditure of resources to drive out defects from the day-to-day operations, shown on the front face of the cube. In other words, the improvement resources should filter through all projects and organizational processes.

How that happens is a large subject which we'll kick off in a future ToP.

Ken Dymond
August 28, 2008