

Should a Level-1 Organization Buy or Build Level-2 Procedures?

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Introduction

This paper defends the claim that, often, an organization at Software Engineering Institute (SEI) CMM level 1 aiming for CMM level 2 is better off buying level-2 procedures from outside the organization than they would be if they developed level-2 procedures themselves. The paper touches on two reasons for this: first, the cost to buy vs. the cost to build the procedures, and second how much buying or building procedures may impact the morale of the organization and its willingness to make another organizational change later.

Procedures Are For Sale Now

Until recently, the question of whether an organization should buy level 2 procedures or build them was purely theoretical. There weren't any procedures for sale. That is not the case now. There is at least one company, in Canada, that has developed excellent written procedures for all six SEI Capability Maturity Model (CMM) level-2 key process areas (KPAs) has offered them for sale. So the question of whether to buy or build level 2 procedures is important now, especially to small companies with limited resources.

Process vs. Procedure vs. Instruction

The claim of this paper is that often CMM level 1 organizations should buy level 2 procedures rather than develop them. To defend that claim, I'm going to have to explain what I mean by procedure.

I'll start with what a process is. According to the SEI, a process can be thought of as a series of procedures.¹ Next, according to the CMM, a procedure is a "written description of a course of action to be taken to perform a given task."² Pausing to reflect on this for a moment, from the SEI point of view a process is something that carries out a series of tasks according to a written description, for each task, of how to do it.

To finish my explanation of procedure, I'll define what an instruction is. An instruction documents how a specific project will perform a given task.

Now, here is what I mean by 'procedure': a written description of a course of action to be taken to perform a given task that is sufficiently general that the description applies across all the projects of an organization. Given that they have procedures, projects develop and carry out instructions. Instructions instantiate procedures for specific projects.

¹Larry Druffel, "The SEI," presentation on Visitor's Day, December 4, 1992, page 8.

²CMM Practices, Glossary of Terms, page A-12.

Getting to Level 2 Requires Procedures

Organizations with software processes at level 2 according to version 1.x of the CMM carry out documented procedures in six KPAs, Requirements Management, Project Planning, Project Tracking and Oversight, Subcontract Management, Quality Assurance, and Configuration Management.

Here are some examples of what level 2 organizations do:

- Estimates for the size of the software products are derived according to a documented procedure
- Work to be subcontracted is defined and planned according to a documented procedure
- Deviations identified in the software engineering activities are documented and handled according to a documented procedure
- A documented procedure is followed to control changes to configuration items.

Each of these explicitly requires procedures.

Cost to Buy vs. Cost to Develop

Most level 1 organizations don't have procedures lying around for use in all the level-2 KPAs. In fact, my experience suggests that most level 1 organizations can't even assemble a collection of staff members who, jointly among them, have carried out all the procedures in all of the level 2 KPAs.

If an organization needs procedures, it only has two choices, it can pay its own people to develop them, or pay someone else.

Buying procedures can have the same advantages over developing procedures in house, such as lower cost and better quality, as buying commercial software has over developing custom software. I will only compare cost. Here's a data point to think over. It took a world-class expert on configuration management approximately three weeks to write the first draft of level 2 procedures for that KPA. The buyer then invested about an additional month of consulting time from a second author to polish them and to make them compliant with DOD-STD-2167A. The same thing happened to the same buyer with the procedures for the quality assurance KPA. A world-class expert spent three weeks on the basic procedures. A project staff member, with consulting help, invested about another month to polish them and to make them compliant with DOD-STD-2167A and DOD-STD-2168. Total cost in each case: about \$30,000. At this rate, a complete set of procedures for all six KPAs would cost \$180,000.

Based on this experience, I estimate that a top flight expert, who had never done it before, could write original, finished, level 2 procedures for a single KPA in about a month working alone. All together then, a complete set of level 2 procedures would require on the order of at least six person months. At \$1,000 per day, experts would cost on the order of \$130,000. An expert who had written the procedures before could do it quicker for less cost. On the other hand, many experts would take longer.

It appears that a complete set of level 2 procedures is available from a source in Canada for \$100,000 or less. Thus, there is already a, still small, market for off-the-shelf software process procedures. In this market, it already would cost many organizations less to buy level 2 procedures than to have them built by outside experts.

The cost difference is even more striking if an organization's own personnel develop procedures. Contrast the costs for outside help with the projected costs to develop level 2 procedures from the beginning in house. Based on data from an actual process improvement project, I estimate that it

would cost a company at least four person years of senior staff time plus additional consulting expenses (including training) to develop a reasonable set of procedures that addressed all six level 2 KPAs. At average rates, the cost would be on the order of \$450,000.

Some of these numbers are rough, but the differences are large. If a company starts from scratch, the cost to develop level 2 procedures is almost sure to be higher than the cost to buy them.

Staff Morale and Future Improvements

It can be hard for the staff of a level 1 organization to conceive a level 2 process. In cases where they have never experienced one, training is not likely to compensate for the lack of experience, for example in KPAs like Configuration Management, or Quality Assurance, or Requirements Management.

If an organization decides to have its staff write its level 2 procedures, an important indicator may appear early in the effort that tells the organization to get outside help. The authors will begin to ask questions about what level of detail is appropriate for the procedures. This is like a cry for help. It's an indication that they are having trouble separating the important parts of their reference material from the unimportant parts. How would you respond if someone suddenly handed you a collection of textbooks on biology, organic chemistry, and chemical engineering and asked you to develop a feasible procedure for producing synthetic insulin? That may be a harder problem than your software development staff will face, but it's the same basic kind of problem.

Left to themselves in this case, without outside help, the authors will become frustrated, morose, and insecure eventually because their problem is too hard to solve. Even if they stay at the company, their effectiveness in the future could be reduced.

On the other hand, if the same people started by testing a set of procedures from external sources, let's say by carrying them out on one or more example projects, then edited the procedures based on the lessons they learned while they were using them, the authors would have a good chance at developing a feasible set of level 2 procedures for their organization. This is how I would develop the procedures if I wanted a high probability of success.

In most cases, it's likely to be much harder for a level 1 organization to write level 2 procedures from scratch than it would be to edit someone else's level 2 procedures on the basis of lessons learned while using them. The first approach, building them from scratch, is likely to fail. Failure is demoralizing, and it inhibits initiative and blocks future willingness to attempt a change. These are risks of taking the approach of building level 2 procedures in house.

Organizations Need Their Own Process Not an Imported Process...Don't They?

Whether they do or not, it is still true that organizations often would be better off buying procedures from another organization than they would be if they built their own. Buying procedures is different from buying software processes.

Processes are composed of procedures like cookies are composed of sugar, milk, and flour. Good managers create good processes, like good cooks create good cookies, by putting the right ingredient procedures together in the right amounts at the right times. Everyone knows that good ingredients are no guarantee of a good cookie, and good cookies are not always made of the best ingredients.

After the procedures have been collected for a process, someone still has to organize them into a process, choose appropriate methods to implement them, write appropriate instructions for each project, and train the proper personnel to carry out the instructions. So, collecting level 2 procedures is only part of process improvement.

After the Procedures, Getting the Horse to Drink

Always, with new procedures, people will have to change the way they do their work. This is inherent in software process improvement, that people must change and do some things differently in the future. Planning and implementing such technology changes are often big problems in their own right.

Organizations that have no procedures of their own for a KPA will have to do two things. First, they will have to get the new procedures somehow. Then, they will have to persuade the stakeholders in the process improvement to change their behavior if the organization is to adopt and practice the new procedures.

It would be a double burden to force the process improvement change agents to face both tasks of building procedures and leading technology change. Buying procedures to edit into a process would relieve some of the pressure on the change agents.

Summary

For many reasons, it's often better (but not always better) for a level 1 organization to buy its level 2 procedures than to build them.