Software Process Improvement in a Small Company/Start Up Environment

Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213

Mary Beth Chrissis
March 5, 2009
Acknowledgements

Most of the material in this presentation has been adapted from material presented by my colleagues at the SEI.

- Suzanne Garcia
- Robert Stoddard

My sincere thanks that they allowed me to reuse rather than create new material.
Topics

General Advice
General Advice for Small Organizations
High Maturity Advice for Small Organizations
References
Summary
Why Small Settings and Start Ups?

Small settings:

- In the United States, 41% of high technology jobs are held by small companies.
- Even higher percentages outside the US.
- According to Statistics about Business Size from the U.S. Census Bureau in September 2008, about three quarters of all U.S. business firms have no payroll. Most are self-employed persons operating unincorporated businesses, and may or may not be the owner’s principal source of income. Because non-employers account for only about 3.4 percent of business receipts, they are not included in most business statistics, for example, most reports from the Economic Census. http://www.census.gov/epcd/www/smallbus.html
- Since 1997, non-employers have grown faster than employer firms.

Small settings represent a different environment in which we need to apply process improvement models, tools, and techniques.
General Advice
An Observation

If you haven’t already realized… many of the problems are the same regardless of the type of organizations you live in.

Whether in large or small organizations, managers and engineers today are faced with many conflicting priorities.

The better your understand your process improvement (PI) choices and what’s needed to implement them, the better the choices you will make.
What We’ve Seen Too Often…
Some Typical Issues in Planning/Executing PI Programs

- Trying to do too much too fast
- Not understanding what it takes for people to be willing and able to adopt new practices
- Lack of objectivity in initial gap analysis (common when a self-taught group tries to perform a model-based gap analysis)
- Underestimating how long/how much it takes to actually perform the tasks related to a process improvement project
- Measuring things that will lead to a different result than the desired behavior
- Becoming too inwardly focused and forgetting that the ultimate goal is to improve your product and performance for your customers.
- Having no baseline data to compare progress against
- Setting goals that are not measurable (remember measurable can include binary yes/no)
- Setting goals that are in no way achievable based on the organization’s current state
Four Things to Remember…

1. You have choices
   - Most improvement approaches assume you’ve already committed to use them when you’re just trying to understand them

2. Your PI effort should solve real problems
   - Getting “Maturity Level X” is NOT solving a business problem (except for the Marketing Dept.!!)

3. Start with things that fit your organization’s culture and history
   - The better the changes fit, the more tolerant people will be and the more open they will be to future changes that may be harder

4. Regardless of the model you choose to guide you, there are competencies to master if you’re going to sustain your process improvement effort
   - *CMMI Survival Guide* is there to help you understand what those are.
Process Improvement Competencies

- Building and Sustaining Sponsorship
- Establishing and Measuring Against Realistic Goals
- Establishing and Sustaining Process Improvement Infrastructure
- Defining and Describing Processes & Their Guidance
- Deploying New or Improved Processes
- Managing an Appraisal Life Cycle

Mapping Typical PI Issues to *CMMI Survival Guide (CSG)* Competencies

- Trying to do too much too fast
- Not understanding what it takes for people to be willing and able to adopt new practices
- Lack of objectivity in initial gap analysis (common when a self-taught group tries to perform a model-based gap analysis)
- Underestimating how long/how much it takes to actually perform the tasks related to a process improvement project
- Measuring things that will lead to a different result than the desired behavior
Mapping Typical PI Issues to CSG Competencies-2

Becoming too inwardly focused and forgetting that the ultimate goal is to improve your product and performance for your customers.

Having no baseline data to compare progress against

Setting goals that are not measurable (remember measurable can include binary yes/no)

Setting goals that are in no way achievable based on the organization’s current state
General Advice for Small Organizations
Scope of CMMI in Small Settings Project

Small Companies

Small Organizations

Small Projects

Some issues are similar across all 3 settings; some are unique to a particular setting.
The Process Challenges of a Small Business Owner...
Some Characteristics of Small Settings

- Lack of Access to “Right” Expertise When Needed
- The “Rules” Keep Changing
- Uncertainty in the ROI that can be expected
- Sustaining Sponsorship Over Time is Difficult
- There’s Never a Good Time to Start a New PI Effort
- Responding to Different Market Demands for PI Strategies is Nerve Wracking
Common Reaction to Problems We Don’t Understand How to Fix

Ignorance is bliss

Denial

AIIEEE

Not a good method for problem solving in any context!
Some Factors Affecting Small Businesses

<table>
<thead>
<tr>
<th>Factors</th>
<th>Small Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Infrastructure</td>
<td>Often Lacking</td>
</tr>
<tr>
<td>Sponsorship</td>
<td>Clear (one way or the other!)</td>
</tr>
<tr>
<td>Apraisal Costs as % of PI costs</td>
<td>High</td>
</tr>
<tr>
<td>Deployment Costs</td>
<td>Low</td>
</tr>
</tbody>
</table>
Challenge Areas for Small Settings Adopting CMMI

The three major investment elements involved in CMMI-based improvement:

- Appraisal
- Definition/Infrastructure Support
- Deployment

Larger companies typically have a resource (though not necessarily skill(!)) advantage with appraisal and definition, but have a distinct disadvantage in deployment.

Appraisal and infrastructure development are the two most visible cost areas for CMMI adoption.
The Appraisal Challenge

“Official” CMMI appraisals (called SCAMPI A Appraisals) consume a larger percent of the budget for a small company than a large one

- $ to hire lead appraisers
- Time away from work for staff to be interviewed
- Time away from work for internal appraisal team

Mitigation suggestions for small settings:

- Use less expensive methods (lots of consultants have them) to do a “pre-appraisal” to be sure that your money for a SCAMPI A will be worth your while
- See if you can get a lead appraiser to use “free” appraisal team resources, i.e., lead appraiser candidates that will volunteer to do an appraisal to help them move forward on their path toward authorization
- If your staff is not already familiar with CMMI, I strongly advise against just doing a self assessment
The Definition/Infrastructure Challenge -1

Defining/redefining processes to adhere to CMMI goals requires

- Model knowledge
- Process definition knowledge/skills
- Knowledge of the organization/company

Many large organizations have all three; most small settings are missing the model knowledge, and often the process definition knowledge and skills are not emphasized
The Definition/Infrastructure Challenge -2

Mitigation suggestions:

- Watch for SEI and other industry publications on implementing CMMI for Small

- If not pressured to implement CMMI fast, take it slow.
  - One or two process areas per month and read them, Connect them to your business issues, and see if you can find simple changes to your existing practices that would adhere to the model and give you more benefit than your current practice (note: there are more books coming out for CMMI “beginners”, eg *CMMI Distilled* by Ahern et al)
The Deployment Challenge -1

The Challenge for Large Organizations/Companies:

• The larger the organization and the greater the variety of business contexts, the more difficult it is to find the “right” level of standard processes/tailoring guidelines

• Often deployment is not only multi-project, but multi-site and multi-customer type

The Challenge for Small Organizations/Companies/Projects:

• “The customer rules” – Many small organizations adopt/adapt their business practices directly from their customers or primes

• Some people self-select into small businesses because they want to “do their own thing” rather than follow corporate norms
Mitigation suggestions:

- Just like with large organizations, *demonstrating your ability to deliver what the customer wants* using your local business practices usually keeps them from forcing their practices on you.

- Depending on the number of customer contexts, may want to create a standard process for each customer type as your starting point.
The Deployment Advantage of Small Settings

The complexity and cost of training employees, creating/using metrics, deploying new templates and job aids is usually much smaller for small companies than large

- Even approaches like “one on one” sessions incorporated into other meeting contexts are feasible in small settings
- People who work in small settings are often, by definition, more flexible than those who have worked a long time in large settings
- Adopting new practices isn’t as much of a challenge for them
The Same Process Improvement Competencies Support Small Settings

- Building and Sustaining Sponsorship
- Establishing and Measuring Against Realistic Goals
- Establishing and Sustaining Process Improvement Infrastructure
- Defining and Describing Processes & Their Guidance
- Deploying New or Improved Processes
- Managing an appraisal Life Cycle

So What Can You Do?
Applying the PI Competencies in Small Setting -1

- Take advantage of the fact that your sponsorship probably equals ownership!

- Don’t take for granted that because you’re small, communication will automatically happen; agree on communication approaches and frequency with your sponsor

- Make sure that your PI goals directly support your business’ goals. “Maturity Level 3” is rarely an appropriate PI goal! Pick the model/framework that aligns most closely with your business problems as your starting point

- Collecting measures is often more difficult in small settings because basic business infrastructure like effort reporting systems are often missing. Try to find synergy between investments needed for PI progress measurement and other business needs.
Applying the PI Competencies in Small Settings -2

- Don’t try to duplicate the infrastructure of the large organizations, but look for places where you can leverage elements of your business infrastructure for process improvement purposes.

- Decide whether you need to plan your infrastructure around staying small, or growing fast – it makes a huge difference in how much PI infrastructure you need to invest in.

- Keep it simple, both in content and representation! Processes in small settings should be simpler because of the small # of communication paths.

- Leverage process guidance documentation’s ability to provide “backup” for critical people in your project/organization who are probably performing multiple roles.
Applying the PI Competencies in Small Settings -3

Deploying New or Improved Processes

- Take advantage of the small # of people you have to deploy new processes/techniques to. If you leverage definition and deployment activities well, you can almost get “self-deploying” processes.
- Small settings often draw people who thrive on change – if this is the case, leverage that quality!

Managing an appraisal Life Cycle

- “Appraisal” here is not meant to imply CMMI-based appraisals – we just mean events that help you determine your progress in conforming to your chosen model/framework.
- If you look at this as a cycle, then you’re more likely to plan multiple interventions instead of just one; we all need progress measures to stay motivated when changing; so you’ll need multiple points where you perform these kinds of activities.

A joint project performed by the partnership between the Software Engineering Institute (SEI) and AMRDEC SED to establish the technical feasibility of developing guidance and other special-purpose transition mechanisms to support adoption of CMMI by small and medium enterprises (25 to 250 employees in Huntsville)

Selected 2 Pilot companies: Analytical Services, Inc. (ASI) and Cirrus Technology, Inc. (CTI)

Pilot artifacts available at the SEI website:

- Toolkit (www.sei.cmu.edu/ttp/publications/toolkit)
- Presentations on the Pilot
Initial Conclusions on Technical Feasibility of Using CMMI in Small Businesses

CMMI provides a set of best practices from which small businesses can benefit.

The continuous representation of CMMI allows small companies to focus on improvements that have the highest payoff for the company while learning about benefits of other elements of the model.

Aligning improvement with business goals is particularly important for small businesses, and in this case was easily achieved.

Simple CMMI-based improvements can have a significant impact in small organizations.

“Changing” the practices within the model isn’t necessary in most cases; finding alternative practices and being creative in work products is often more relevant.

Both CMMI and SCAMPI A (the CMMI appraisal method) scale down to fit small settings.

*The greatest challenge for small businesses is the affordability of subject matter experts, and the infrastructure and appraisal costs.*
High Maturity Advice for Small Organizations
When and Why Do We Need Process Performance Models at the Project Level?
Contrasting Large vs Small Settings

Origination of Models
Staffing Model Development
Method to Build Models
Accessing Enough Data
Data Collection and Storage
Analytical Tool Choices by Type
Interpreting and Documenting Results
Use in CAR Process Area
Use in OID Process Area
Importance of the DAR Criteria
Origination of Models

Large Settings
Inspiration for models comes primarily from Strategic Planning and annual Business Goal Setting

Engineering Process Groups may also initiate models as needed

Senior Technologists may initiate models to address product risk

Small Settings
Inspiration for models derived from direct customer interactions and needs, and real-time business risks

Generally a bottom-up approach with team review and usage

Individuals may create personal models for their own use
Staffing Model Development

**Large Settings**
Dedicated individuals, if not entire teams, resourced to build models at request of Senior and Middle Managers

Staff generally trained in model development via internal training curriculum

Some experienced model builders hired externally

**Small Settings**
Several or many members of project knowledgeable in basic modeling

Generally, a bottom-up approach with team review and usage

Staff receive training externally

Occasionally, a temporary contractor may be hired
Method to Build Models

Large Settings
Generally, process improvement teams follow a structured process, similar to Six Sigma DMAIC, to develop the models.
Model development passes thru management review gates to ensure a successful model.

Small Settings
A streamlined process for model development is followed.
The process may be quite informal and executed by a single person.
Generally takes less time.
Generally, possesses less documentation as the author is the only user.
Accessing Enough Data

Large Settings
Large amounts of historical data sitting around possibly not being used

Requests for new data fields very difficult as organization has a bureaucratic process to handle new requests

The organization is reluctant to change data fields

Small Settings
Normally very little historical data

Historical data unique and dependent to individuals

Normally real-time sampling of data occurs

Easy to collect new fields with almost no approval

May need to collect data across projects
Data Collection and Storage

Large Settings
Data collected from massive workflow automation systems
Data automatically shared across databases with highly centralized databases accessible to model builders
Mature data entry screens catching input errors

Small Settings
Paper records
Excel spreadsheets, possibly shared on a network drive
Data manually collected by many, if not most, project members
Variability in data format, integrity, quality, timeliness
Analytical Tool Choices by Type

**Large Settings**
Expensive, network shared, possibly enterprise-wide analytical tools

Purchased on a volume discount sometimes reaching 1% of normal license fees

Conflict exists as the organization mandates a standard tool to use

**Small Settings**
Individual licenses pursued if fit in the budget

Desire to find freeware if possible

Excel platform desired

Single licenses of expensive tools shared among team with default user

Variety of tools in use
## Interpreting and Documenting Results

<table>
<thead>
<tr>
<th>Large Settings</th>
<th>Small Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedicated users of models author formal reports on the results and conclusions</td>
<td>Notes are recorded in the journal or notepad of the statistical package</td>
</tr>
<tr>
<td>White papers and other internal publications may be used</td>
<td>Callouts on powerpoint slides summarize the conclusion and action</td>
</tr>
<tr>
<td>Reporting templates are used to ensure stability as different people assume the key user role</td>
<td>Meeting minutes document the interpretation, conclusions and actions</td>
</tr>
<tr>
<td></td>
<td>Individual personal notes</td>
</tr>
</tbody>
</table>
Use in CAR Process Area

Large Settings
Predictions are made and if unacceptable, CAR may be initiated by team.

Prediction intervals are established and serve as early warning indicators; if actual performance is outside of the interval, CAR may be initiated by team.

Small Settings
Individuals view the results of their predictions and act immediately.

Some actions may be communicated to rest of team.

Individuals more readily have insight to what is going on when reacting to model results.
Use in OID Process Area

Large Settings
Enterprise systems established to collect and analyze innovative improvement ideas
Standard organizational process performance models used to screen ideas
Models used to generate ideas for improvement

Small Settings
Individuals with complete domain knowledge
Subjective real-time assertions of innovative improvements
Models primarily serve to add confidence, or to handle completely new situations
Dynamic models can predict new performance
Importance of the DAR Criteria

Large Settings
DAR criteria needed to ensure a large number of model builders, analysts, users of statistical management charts and model results are consistent and to avoid confusion
DAR needed to guide different org segments in choosing models, etc…

Small Settings
DAR criteria primarily needed to guide individuals on when to use more formal modeling approaches, and when to inform others of the results
DAR criteria needed also for segmenting projects as they collectively use each other's data fields
References
Provided Material for this Presentation

The subtitle Rich and SuZ really wanted...

The IPSS Field Guide

How-to guidance for establishing and sustaining process improvement; independent of the process model or standard used

Prototype for a Field Guide for Improving Processes in Small Settings

Suzanne García
Caroline Graefinger
Chris Cambry
Mary Lynn Peen
March 2008
DRAFT

Software Engineering Process Management
Unlimited distribution subject to the copyright

Minneapolis SPIN Meeting
Chriissis  March 5, 2009
© 2009 Carnegie Mellon University
References

Improving Processes in Small Settings project
  • http://www.sei.cmu.edu/iprc/ipss.html

For SuZ Garcia presentations, including all those she has written related to the Huntsville pilots
  • http://www.sei.cmu.edu/ttp/presentations

CMMI in Small Settings Toolkit Repository from AMRDEC SED Pilot Sites
  • http://www.sei.cmu.edu/cmmi/publications/toolkit/

Proceedings of the First International Research Workshop for Process Improvement in Small Settings, 2005
  • http://www.sei.cmu.edu/publications/documents/06.reports/06sr001.html
References

Tools Supporting CMMI High Maturity for Small Organizations presentation, Robert Stoddard, September 2008
  • www.sei.cmu.edu/sema/presentations/stoddard-tools-smallorgs.pdf

  • http://www.stsc.hill.af.mil/crosstalk/2008/02/index.html
Summary
Knowledge is Power!

When you understand the competencies that are involved in process improvement (regardless of the model being used or the environment they are being applied)

• You understand why many software engineers have trouble transitioning into a process improvement role

• You can appreciate why it’s difficult to get a PI effort going, and also challenging to sustain one

• You have a better idea what activities you can do yourself, and which ones you should do with external assistance

• You can start educating people who want to be involved in improvement efforts in productive areas

Bottom line: you have choices, so understand them well enough to make the right decision for YOUR environment!
You CAN Tame the Dragons
Expand the Known World of Process Improvement!!!
THANK YOU!