

Achieving successful software process improvement in smaller organizations

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UNSW Organisation

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Slides will be available at

<http://www.caeser.unsw.edu.au>

The company landscape

- Allette Systems (<http://www.allette.com.au>)
- Sydney-based SME/ web application development
- ~ 20-30 staff, flat management structure

How can we successfully do SPI in the small? (Contents)

1. The nature of the organizations.
2. Applicability of established SPI approaches
3. A model for improvement
4. Experience with SPI on two projects
5. The way forward

The organizations - cultural differences

- Significant cultural differences exist between small organizations and larger ones
- Members of small organizations interact differently from those in larger more complex organizations, *"they are a tight cohesive team who share a common vision, who believe that communication takes place through 'osmosis' and 'do whatever needs to be done, the rules don't apply to them (they just get in the way of getting the job done), they live with short cycle times and high stress."* (Paulk 1998).

The organizations - creativity and innovation

- Their success is often due to the creativity of and innovation of their employees. However SPI is often viewed as the antithesis of these qualities, leading to bureaucracy that restricts the freedom of individuals. It follows then that any SPI initiative in a small organization should use the creativity of individuals within the organization to provide innovative solutions to SPI problems. The outcome of SPI should not stifle creativity it should focus creativity on project-specific problems, not standard process issues (Kelly and Culleton 1999).

Factors to consider

- High dependency on individuals
- Small number of employees
- Impact of the human factor
- Dependence on a small number of projects
- Importance of customer communication
- Difficulties with SPI investment and SPI personnel

Observations in Allette

- Time pressures in the workplace may make it hard for a researcher to talk to staff. They want results and improvements without providing much input, at least little personal input.
- They do not necessarily have a good feeling about research or positive knowledge about it. It may be hard to communicate what you need from them as they do not always have a university background, sometimes they even feel scared when you ask them things. They feel tested or observed.

Observations 2

- The (knowledge) gap between industry and research - its hard to implement research methods or processes without knowing the practices at the company. Example: COSMIC size measurement which needs to be tailored for specific environments. It's too generic and high level. The examples are old and not up-to-date in their latest manual.
- These issues highlight the interpersonal characteristics when working in a small organization.

The Software Process Improvement Landscape

- Software methodologies aim for consistency and repeatability, but is this the opportunity?
- Benchmarking, analytic and tool-based paradigms. Examples.
- “Agile” methods.. Extreme programming
- CMM, SPICE et al.
- The need for SPI in the small.

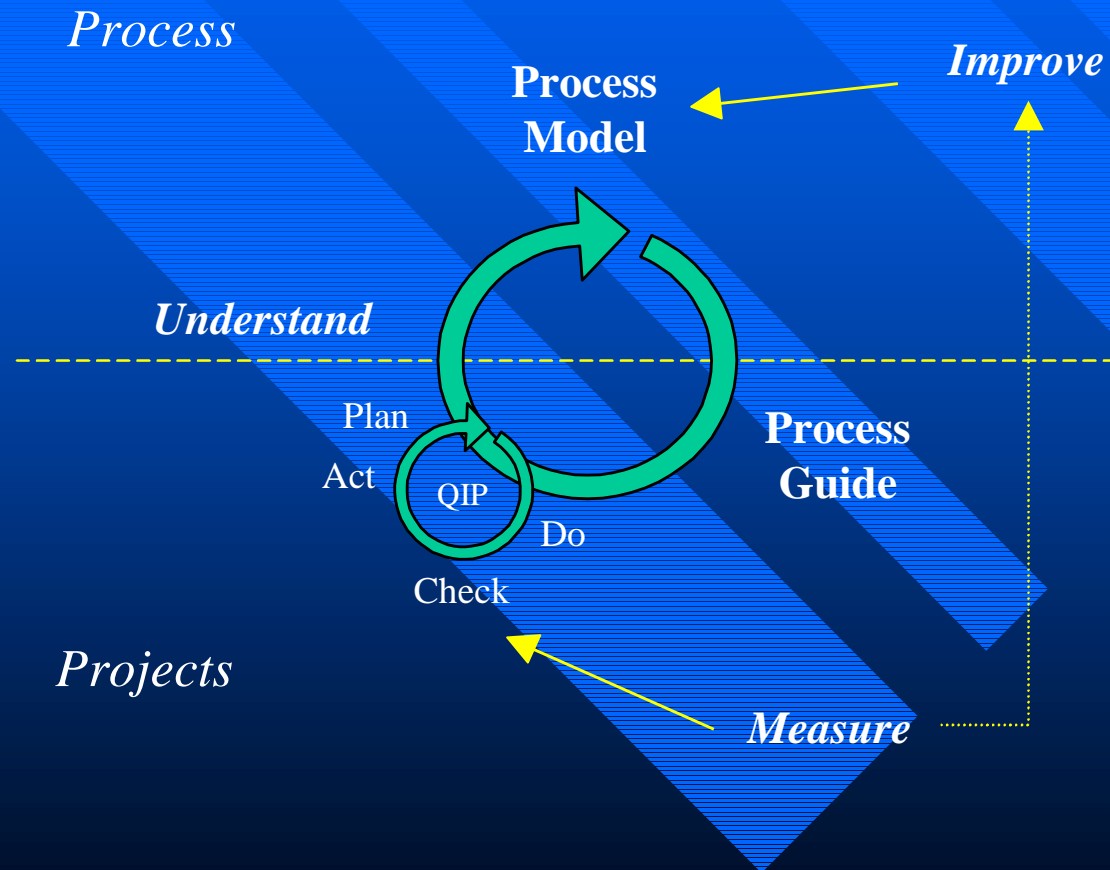
The direction

- For a small organization to introduce a sustainable SPI initiative, it must minimize the limitations of its smaller size and maximize the benefits inherent in its culture, emphasizing the need for tailored approaches.

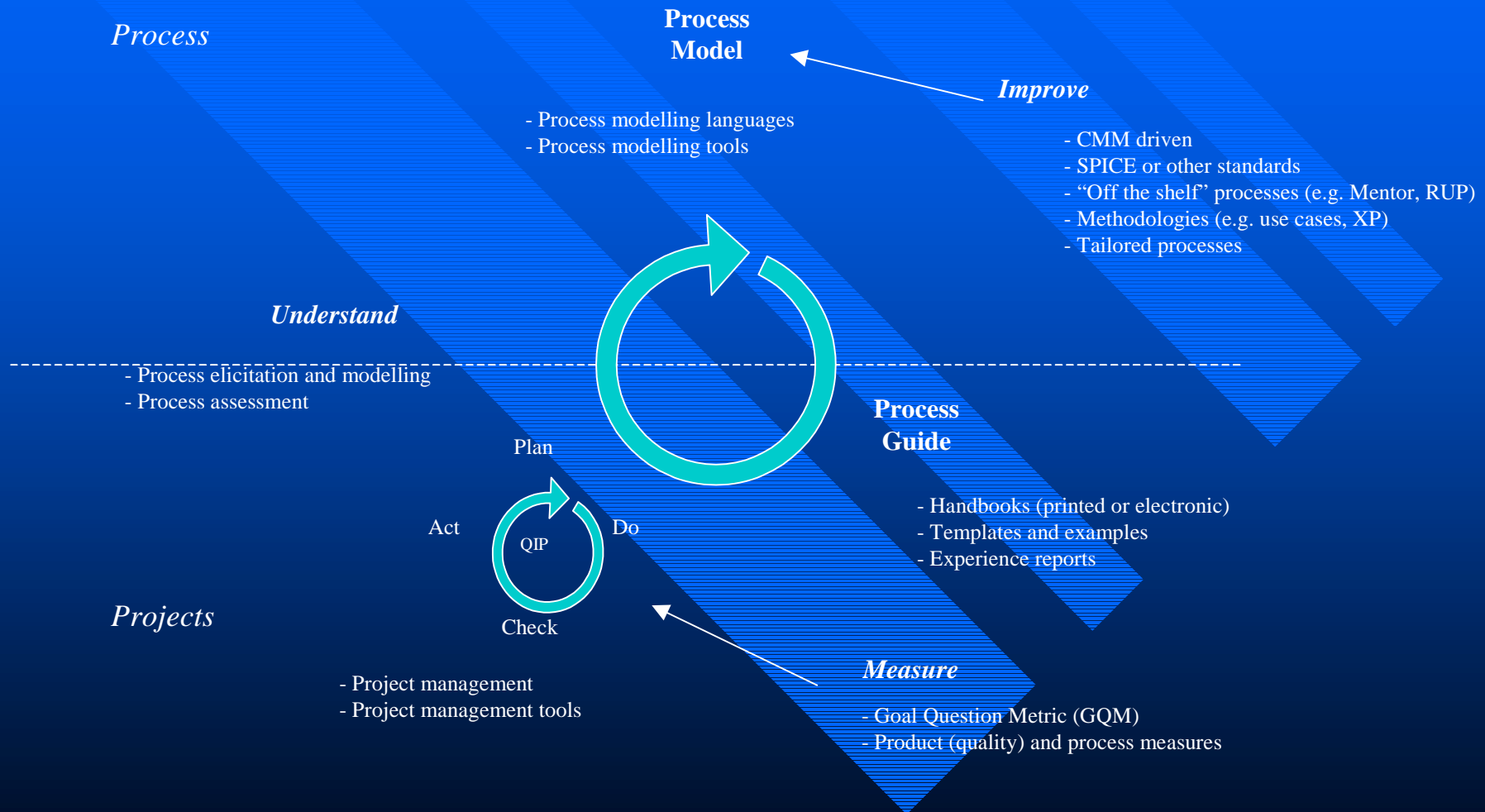
Project 1 at Allette

- The IMPACT Project and history

The IMPACT Framework



IMPACT with Examples



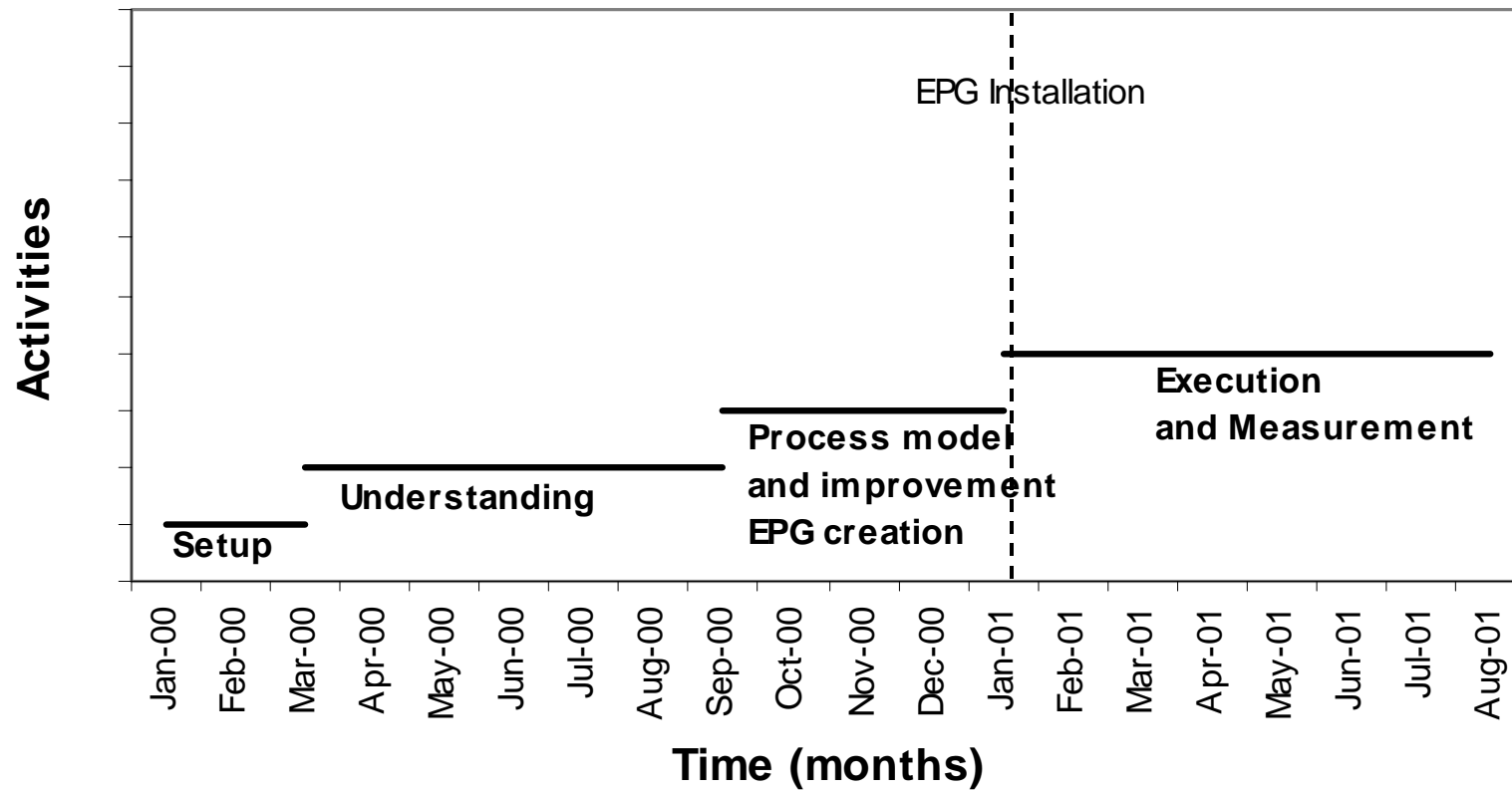
Process Level - Allette

- Five step structure for managing SPI at an organizational level:
 - Understand,
 - Process Model,
 - Improve,
 - Process Guide and
 - Measure.

Advantages of this kind of approach

- It is incremental which means that it can be initialized with a relatively small investment and then incrementally extended. Increments can be short and ideally match project cycles,
- It gives fast, tangible results so that its continuation can be justified,
- It can utilize existing technologies (such as assessments, CMM etc.) to reduce the cost to the company and to get maximum advantage from the work that has already been done in this field.

Project Timeline



Understand

- The existing processes were elicited and modeled using project documents and e-mail analysis and interviews.

Process Model

- The process model resulting from the understanding phase was a snapshot of a process from a particular project. The model identified many areas of possible improvement including requirements management, testing and evaluation, and documentation.

Improve

- Through discussion with the company we decided to focus on documentation as the goal of the first cycle of improvement. The ISO 12207 standard was used as our guide to improvement. A streamlined version of the ISO 12207 focusing only on key documentation was created as the process model.

Guide

- The streamlined version of the ISO 12207 model was entered into the Spearmint/EPG tool which then generated an electronic process guide (EPG) to guide the new processes. (Now “Wagner”)
- The EPG was then ‘seeded’ with annotation points by a product called PageSeeder. This allowed the EPG to be annotated and the annotations shared by email with project members.
- Allette produced their own templates. Ten templates and an overall drafting guide were produced. These templates were then converted to HTML and both Word and HTML versions were hyper linked to the EPG.

Execute the projects

- Though the new process was used with several small projects it was mainly studied in relation to one medium sized project (approximately 800 hours work).

Measure

- The impact of the process improvement effort was measured through periodic questionnaires distributed to process participants and monitoring of the pages subjects accessed. The questionnaires identified positive and negative effects and features of the approach and how the approach could be improved.

Process level

IMPACT Framework at Allette				
<i>Understand</i>	<i>Process Model</i>	<i>Improve</i>	<i>Process Guide</i>	<i>Measure</i>
Emails and project documents analysis were the data used in this step.	Snapshot of a process was generated but not really used as basis for a repeatable process model.	Documentation process was the chosen target for improvement.	A streamlined version of ISO 12207 was generated in an electronic process guide and installed in the company.	Measurement was done through periodic distribution of questionnaires and monitoring of page hits.

Benefits of EPG and process

- Better understanding and raised consciousness of work practices
- Improved project definition, estimation and management
- Assisted in project execution
- Stimulated discussion
- Improved documentation
- Improved relationship with customers
- Positive ROI

Positive features of EPG

- Access to information was easy and fast
- Provided on-line discussion forum
- Provided templates for documents
- Was easy to keep up-to-date

Most common uses

- Access templates
- Define task lists for projects

Interesting results

- There were tangible benefits of installing the EPG at Allette Systems.
- There were no negative effects of installing the EPG at Allette Systems.
- No one didn't use the EPG because they didn't like it.

Project 2 Estimation Improvement

Cost estimation needs information about previous software development projects

⇒ Often not available or not complete

Many cost estimation tools are available

⇒ black-box models

⇒ inaccurate

⇒ difficult to calibrate

Expert estimation

⇒ Depends on their availability

⇒ Depends on their experience

⇒ Knowledge is not accessible by others

Allette Estimation

- Application of cost estimation models did not exist
- Data about previous projects was not complete for building a cost estimation model
- Cost estimation depended on experts
- Process was not repeatable

CoBRA: Cost, Benchmarking and Risk Assessment

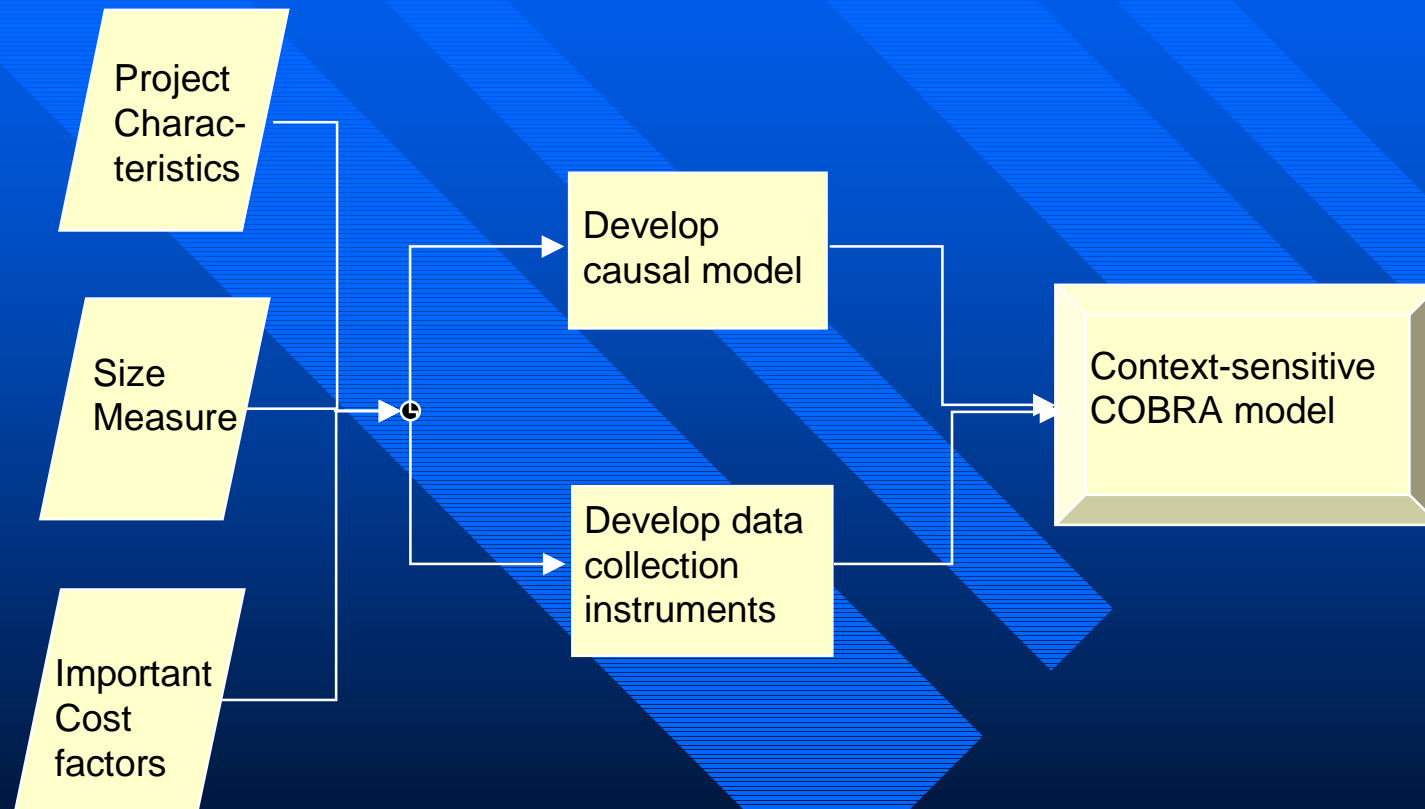
Input

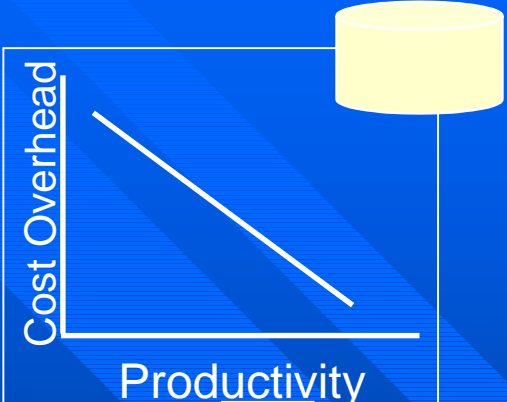
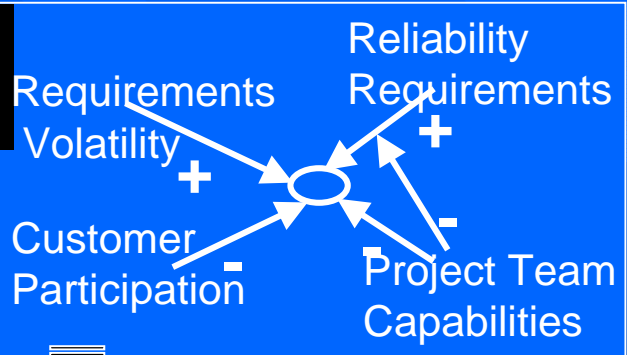
- Project characteristics
- Identification of context-specific (subjective) cost factors based on expert knowledge
- Integration of quantitative project data (size, effort)

COBRA

- **Outcome**
- Probability-distribution of the costs based on Monte-Carlo-Simulations

COBRA – Process I





Project Data
Questionnaire

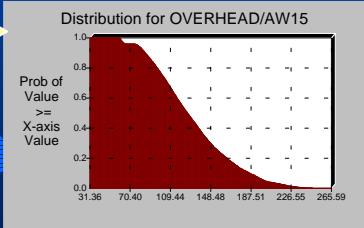
F1: low

F2: high

F3: high

...

Simulation



COBRA - Advantages

- Process
 - Repeatable, independent from experts.
- Data
 - The model can be built with data on a few projects (say 10).
- Size measure
 - COBRA does not depend on a specific size measure (but size needs to be measured).
- Risk analysis
 - Integrated Risk Analysis to measure risks.
- Application
 - Application of the COBRA model generated good results in other environments.
- Model development
 - Effort to build the COBRA model is independent to the environment.

Conclusions (1)

- This industry has three issues that we seek to address:
- 1. Maintenance and diffusion of capability. In the 1980's there were organizations in Australia that could deliver measured quality software solutions in half the "normal" time. This capability was based on technical and management knowledge. This knowledge was not codified nor made available outside the particular organization and lost as the people with that knowledge left the industry.

Conclusions (2)

- 2. Expert evaluation of technologies and methods. Independent scientific evaluation is needed in an industry of fast change and untested ideas.
- 3. Access to the latest tools, techniques and methods from anywhere in the world and the opportunity to demonstrate the quality of our own.

Conclusions (3)

- Deliver these outcomes by partnering research and practice to:
 - 1. Codify and store (package) best industrial practice along with evidence of the strengths, weaknesses and applicability of that practice.
 - 2. Provide an electronic portal for easy industrial access to the packaged practices.
 - 3. Assist industry in delivering quality improvement through the application of state of the art technologies wherever they have been developed.

Conclusions (4)

- The **approach** to be used is the idea of so-called laboratory environments, which evaluate existing software projects and new approaches, package the experience from use, and support technology diffusion.

Conclusions (5)

- **Benefits** of the establishment of ACCIT include:
 - 1. Easy industrial access to leading approaches for software quality.
 - 2. Ensuring continuance of successful approaches.
 - 3. Access to information on the applicability and strengths and weaknesses of different approaches.

Conclusions (6)

- 4. Maintenance of competitive advantage over time as improvement is gained.
- 5. Establishment of a world-leading competence centre in empirical software methods which can feed industrial growth through successful deployment of information technologies.
- 6. Attraction of job-generating organizations to an effective research partnership.

Conclusions (7)

- 7. Industrial linkage that can feed relevant information into IT education.
- 8. Through linkage with Europe and the USA, then Australia and New Zealand can build a sustainable international reputation in IT quality.

Nowhere is this needed more
than in

SMEs

(but we do not rule out larger
organizations)

Thank you

References

- Preliminary Results of an Industrial EPG Evaluation, Scott L, Jeffery D.R., Becker-Kornstaedt U., 4th ICSE Workshop on Software Engineering over the Internet, Eds. F.Maurer; B. Dellen; J. Grund; B. Koetting, Toronto Canada, 12-19 May. 2001, IEEE Computer Society, California, USA, pp55-58.
- An Evaluation of the Spearmint Approach to Software Process Modelling, Scott L, Carvalho L, Jeffery R, D'Ambra J, Software Process Technology: 8th European Workshop EWSPT2001, Eds. Vincenzo Ambriola, Witten Germany, 19-21 Jun. 2001, Springer-Verlag, Berlin, pp77-89.

References

- Practical Software Process Improvement - The IMPACT Approach, Scott L, Jeffery R, Carvalho L, D'Ambra J, Rutherford P, 2001 Australian Software Engineering Conference, Eds. Douglas D.Grant; Leon Sterling, Canberra Australia, 27-28 Aug. 2001, IEEE Computer Society, Los Alamitos California USA, pp182-189.
- A Hybrid Method for Software Cost Estimation and Risk Assessment, F. Bomarius L. Briand & K. El Emam, IESE-Report No. 055.97/E Version 1, Dec. 31, 1997