

# Can Australia Improve Its Software Processes?

Alastair James<sup>1</sup>  
STM Consulting

*It is critical to the competitiveness of Australia's information industry that the software industry maintains world-class performance by employing best practices in all its business aspects, but most particularly in software development and acquisition. Software Engineering Australia (National) commissioned research on the key quality and process improvement issues being faced by Australia's software industry<sup>2</sup>. This article examines the current quality and processes improvement status of Australia's software industry.*

What is the current status in quality and process improvement of Australia's software industry? The consensus is that Australia needs to move quickly to adapt and deploy the tools available in order for its software industry to have the best opportunity for future global competitiveness. This view is based on discussions with key players in the field – acquirers, research institutes, and consultants – and on additional desk research.

Almost all information industries' products involve software, whether it is explicit software systems or software embedded in electronic products or systems. A recent report published by the Information Industries and Online Taskforce, *The Stocktake of Australia's Information Industries*<sup>3</sup> had this conclusion:

... Australia could become a significant global player in a range of information industries segments and, arguably, has a strategic imperative to do so. Australia's performance to date has shown substantial promise of our ability to achieve this goal ... Australia has world class strengths in many aspects of the information industries. We are advanced users of IT&T, with most measures putting us amongst the highest per capita in the world ... Our information industries have advanced and demanding clients in sectors such as finance, retail, air transport, government, energy, agriculture and mining, for which the industry has designed world-class solutions.

It is clear, then, that for the global potential of Australia's information industry to be achieved, Australia's software industry must be among the world's leaders in employing appropriate technologies. That includes employing best practices in all its business aspects.

## Quality and Process Improvement Benefits

The British Standards Institution (BSI)<sup>4</sup>, which has been active in the development of software quality standards, admits that it is generally accepted that the costs of poor software quality are much easier to quantify than some of the benefits of implementing quality systems and process

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improvement. The costs to the developer of rework and after-sales support, and to customers associated with system non-availability and maintenance charges, are more clearly visible.

The benefits of using a quality system lie in improvement in quality and repeatability reflected in increased customer satisfaction, higher process efficiencies, and a reduction in failure costs. Failure costs

typically comprise costs of correcting defects, cost of overruns against time and budget, unnecessarily high maintenance costs, and loss of business due to poor reputation.

The BSI quotes typical failure costs of up to 20 percent of turnover for developers without a quality system, and that up to half these costs could be saved by implementation of a quality system.

Case studies of Australian and overseas software projects also highlight the benefits to both developers and acquirers of adoption of software quality and process improvement technologies. Benefits for developers include higher quality and productivity, faster delivery and time to market, lower costs, and higher profitability; for acquirers, greater predictability of scheduling, quality and cost, and thus lower risk and happier customers/users.

Several initiatives in software process improvement are underway or being developed in Europe. It appears to be a common characteristic of software industries that awareness of the benefits of quality and process improvement are greatest in larger organizations, and therefore many programs focus on addressing the needs of smaller developers.

In a paper to the Software Engineering Australia 2000 Conference in Canberra, Australia, Fran O'Hara, principal consultant at Insight Consulting Ltd, Dublin, reported that uptake of software process improvement (SPI) “has not yet become ingrained into the culture of the software industry in the manner that it now is in the U.S.” Other commentators suggest that, while awareness of SPI is greater in the United States than elsewhere, adoption has been principally among the larger firms.

The Software Process Improvement in Regions of Europe (SPIRE) program is an

example of an initiative aimed at the small and medium enterprise market. SPIRE is a European Systems and Software Initiative project financially supported by the European Commission. The Centre for Software Engineering in Dublin undertook the project in Ireland and coordinated activities with partners in Austria, Italy, and Sweden.

SPIRE targets the needs of software development groups with up to 50 staff (either in small software companies or small software units in larger organizations). It has been piloted in more than 70 organizations. A key feature of the work has been the analysis and dissemination of the results through a Web database so that others can learn from the pilot's experience.

The results showed measurable improvements across participants in all the countries where the project was run. The project was undertaken at no charge to participants, who record high levels of satisfaction with the results. Clear evidence of success is demonstrated by the fact that more than three-quarters of participants felt that they would definitely continue improvement projects without any form of external funding.

Although a range of SPI approaches have been deployed in overseas markets, the majority are based on Software Process Improvement and Capability Determination (SPICE) or the Capability Maturity Model® (CMM®) approaches, in some cases locally adapted to suit the needs of smaller companies. SPICE is an international initiative to develop a widely accepted standard for software process assessment involving groups in many countries around the world. Sponsored by the U.S. Department of Defense (DoD), CMM has been developed at the Software Engineering Institute at Carnegie Mellon University.

Despite the demonstrated benefits of software quality and process improvement, why have smaller software developers overseas and in Australia been slow to adopt technologies that will have clear short-term benefits on their bottom line, and in the longer term may be crucial to the industry's international competitive survival?

## Activities in Australia

In Australia, there is no definitive current information on the levels of adoption of quality software assurance and process improvement methods among developers. Nevertheless, anecdotal evidence suggests

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awareness and adoption among small-to-medium enterprises is very low.

According to Geoff Bowker, a software engineer and former executive director of SEA in New South Wales, Australia, there are several potential factors affecting take-up of software quality and process improvement technologies. While awareness of such technologies may be high among larger acquirers and developers, the level of general awareness of both the availability of solutions and indeed of the problem is an issue.

Many acquirers, including systems integrators and consultants advising acquirers are not aware that approaches are available to improve their confidence in on-time, on-budget, on-quality delivery, and thus create happy customers. Equally, while some developers have adopted quality standards (for example ISO 9000 series), particularly among small-to-medium enterprises, there is no widespread recognition that technologies are available to address the specific software development and acquisition processes.

Among those with some awareness of process improvement technologies, there is often a perception that they are suitable only for large organizations, that they are costly and time consuming to implement, that their benefits are not proven, and that they require a major commitment of resources. This suggests that many organizations have not been able to link these technologies with the business objectives of reduced cost and improved productivity and customer satisfaction.

A chicken and egg situation in the market for SPI may partly explain low levels of awareness and adoption. Although ongoing work has been proceeding for several years within institutions such as the Software Quality Institute (SQI) at

Griffith University and the Australian Software Engineering Institute (ASEI) in South Australia among others, commercial products and services have only recently begun to emerge in the Australian market. Those that have been available have mainly been U.S. developed, and have proven unsuited in their original form to the needs of the typical Australian software company. On the other hand, had there been greater demand, local organizations would undoubtedly have responded earlier with adaptations more suited to local needs.

The DoD, as a major acquirer of software intensive systems, has been in the forefront of investigation of approaches aimed to reduce risk in software acquisition. Within the Defense Materiel Organization, a Software Acquisition Reform Program has been established to review approaches, conduct trials, and develop strategies to achieve this aim. These will need to embrace people, processes, and technologies, on the part of both acquirer and developer, to reduce risk and improve software quality.

So far, one benefit from the U.S. industry's experience is an emphasis on SEI's CMM programs at Carnegie Mellon University (a body sponsored by the DoD). Other initiatives include sponsorship of work with SQI on Capability Maturity Model Integration<sup>SM</sup> and SPICE methodologies, with the results being fed back to SEI, and liaison with the UK Ministry of Defense.

Some might dismiss such programs as being aimed at large defense contractors with little relevance for Australian small-to-medium enterprises. However, as many larger defense contractors in Australia subcontract work to small-to-medium enterprises, there are obvious benefits if both prime- and sub-contractors are working within the same quality framework. Also, many of the quality improvement elements of these programs are generic, with potential impact throughout the software industry. CMM programs have been adapted to the needs of smaller organizations, too.

In collaboration with SEA<sup>2</sup>, SQI has recognized the need for approaches that can generate incremental improvements to demonstrate business benefits, particularly

for smaller developers. According to Professor Geoff Dromey, director of the institute, a new Rapid Assessment Program (based on SPICE technology) has been developed. About 30 Queensland software developers have successfully completed trials. Companies such as these typically do not appreciate the strategic benefits of SPI programs. They are too busy running hard to complete projects to be able to justify dedicating the required resources, so quick results are required.

The program provides a relatively low-cost combination of assessment, mentoring, and training during about six months to deliver a structured framework for the developer to implement ongoing improvements. SQI was founded in 1991, and has worked extensively with overseas institutes, including SEI, on SPICE and CMM programs among others.

The ASEI in Adelaide has also responded to a similar need for affordable, bite-sized, easily digestible programs suited to small-to-medium enterprises. Founded in 1995, ASEI is a cooperative enterprise between the software industry and academic and research institutions in South Australia and is supported by the South Australian Government.

Apart from a few larger branches of defense contractors, all software developers in South Australia are small-to-medium enterprises. ASEI is developing a suite of services called Sound Software Engineering Practices for small-to-medium enterprises tailored to their needs as identified in research. In phase one of these services<sup>2</sup>, emphasis is on configuration management, which the research highlighted as a major issue in more than 60 percent of small-to-medium enterprises. ASEI also has plans to roll out other modules addressing further SPI areas.

The phase-one service includes a high proportion of customized assessment and mentoring time that provides considerable flexibility and adaptability. Therefore it depends on the availability of trained and experienced staff for implementation. Trials have been successfully completed with 15 small-to-medium enterprises (mostly South Australian, but one each from Victoria and Northern Territory).

## Conclusion

There appears to be much good work in software quality and process improvement taking place in Australia. Increased activity to publicize that there is a better way to build and acquire software will result in higher awareness and create demand for the programs becoming available. This then raises the issue of how to ensure adequate resources with appropriate experience and training to support a national rollout.

If deployed more widely, programs tailored to the needs of small-to-medium enterprises, can assist in promoting the concept that worthwhile returns can be achieved on modest investments of time, resources, and money. ♦

## Notes

1. Alastair James, director of STM Consulting, undertook research for this report on behalf of SEA.
2. These research programs were funded through the Department of Communications, Information Technology and the Arts via Software Engineering Australia's (National) (SEA) project funding.
3. Stocktake of Australia's Information Industries, A report by STM Consulting Pty Ltd for the Information Industries and Online Taskforce, DIST, Canberra, 1998
4. [www.ticket.org/quality.htm](http://www.ticket.org/quality.htm)

## SEA Profile

This article is reprinted with editing from the Software Engineering Australia (National) (SEA) Software Journal, November 2000. SEA is an industry-led body with the charter of improving the quality and reliability of software in Australia. SEA is supported by the Commonwealth through the Department of Communications, Information Technology, and the Arts.

To achieve this Charter SEA focuses on these three core mission statements:

- Provision of information and services to assist entrepreneurs and managers to build evermore robust software businesses focused on exceeding customer expectations (business development).
- Provision of services for both developers and acquirers of software and software systems support for the continuous but rapid improvement of productivity, timeliness, and quality levels.
- Smoothing the path to new technology awareness, understanding, and adoption.

SEA works collaboratively with domestic and global alliances, with government departments, organizations, and professional bodies to drive its mission. SEA serves as an information network to all those in the software industry involved in the research, development, production, acquisition, and use of software in Australia.

E-mail: [info@seanational.com.au](mailto:info@seanational.com.au)  
[www.seanational.com.au](http://www.seanational.com.au)

## Letter to the Editor

Dear **CROSSTALK**:

Theron Leishman's June 2001 article, *Extreme Methodologies for an Extreme World*, is a nice introduction to the agile-methods world. However, Figure 4, "Evolutionary/Spiral Model," is not the version of this model being endorsed by the DoD 5000 series of regulations. It is instead an Incremental Waterfall process, an example of the "Hazardous Spiral Look-Alikes" that Fred Hansen and I discussed in our May 2001 CrossTalk article, *The Spiral Model as a Tool for Evolutionary Acquisition*. Assuming that a point-solution design for the requirements in increment 1 can be scaled up to the requirements of future increments may work well for small projects

done by refactoring experts, but will generally be a disaster for larger-scale and embedded systems.

One way to fix Leishman's Figure 4 is to replace the "Requirements Analysis, Preliminary Design, ..." segments of the spiral by "Inception, Elaboration, Construction and Transition." These phases, used by the Rational Unified Process and MBASE, use risk considerations to determine under what conditions an extreme method or a more heavyweight method will best fit the system's needs.

Sincerely,  
 Barry Boehm  
 University of Southern California