

SOFTWARE QUALITY ACCREDITATION
IN THE
AUSTRALIAN CONTEXT

THE REPORT OF THE
SOFTWARE QUALITY ACCREDITATION WORKING PARTY

February 2005

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Chair's foreword

Australia has developed a strong position in the global software industry. This strength derives from our education system, our cultural values and our creative spirit. At this point in history, given increasing globalisation of the industry, it is time to evaluate our achievements and to make recommendations to government and industry which look to the future competitiveness and sustainability of the industry rather than past successes.

One significant factor in the globalisation of the software industry has been the ability of a number of relatively low cost regions to develop a demonstrated capability in the development of quality software of certain types on schedule and budget. This has occurred at a time when there has been an increased focus on delivering quality software on schedule.

So the issue we face is one of industry restructuring in a relatively newly globalised context. Decisions need to be made now to ensure the future competitiveness of our software development industry given that this industry is pervasive in practically all industries. If we are to be fully competitive in automotive, financial, mining or primary industries for example, we must be competitive in the software industry. To be competitive we must have the capability to develop high quality software in a manner which allows competitive advantage to the industry sector concerned.

But what do we mean by 'high quality software'? It is often suggested that 'quality is hard to define, difficult to measure, but easy to recognise'. It has been defined by the International Standards Organisation as 'the totality of features and characteristics of a product or service that bear on its ability to satisfy specified or implied needs'. This begs the question though of whose needs are to be satisfied. The software industry has many stakeholders including the software developers, users, and purchasers.

In this report we position the importance of software capability accreditation in achieving software quality and organisational success in today's global software market. There are actions that are needed today and there are outcomes and perceptions that will be changed in the longer term through these actions.

The Software Quality Accreditation Working Party has prepared this report over a period of four months. The process has considered the experience of large and small organisations, professional societies, industry associations, software accreditation organisations, industry research reports, and researchers. The members of the working party have brought to the process a wealth of experience covering many years of involvement with the software industry in Australia and overseas. We have found that software process improvement is a key element in the success of the software industry and that at present there is a need for greater awareness, particularly in the SME context, of process improvement and its relationship with process accreditation, and software quality.

It has been a pleasure to Chair this working party and to have the opportunity of working with the members of the team. It is important that industry and Government

continue to work together to create a long-term high quality software industry in Australia.

Ross Jeffery
Professor of Software Engineering UNSW, and
Empirical Software Engineering Program Leader
National ICT Australia

Summary

A common misconception is that software quality accreditation (SQA) would universally help the software industry, just as accrediting accountants or doctors helps their respective industries. But SQA does not certify people or products. It accredits the process, the ‘means’ by which software is produced. Whilst having software processes are important, having SQA does not guarantee success on the world stage. In context, SQA is not a magic wand and, worse, mandating it inappropriately (by business or government) could be detrimental to the local industry.

The software industry is different from other industries. It is pervasive, diverse, complex and growing. There is no reason why Australia cannot be and/or continue to be leaders in given software fields. This is because software is an intellectual pursuit:

- No culture has a monopoly on creativity and great designers can come from anywhere in the world.
- Economies of scale are not a prerequisite for success.
- Productivity between programmers can vary by up to a factor of ten.

Globally there is a trend to reduce costs and commoditise certain elements of software development, e.g. through offshoring. While potentially a threat, it can also present opportunities for industry growth. By moving up the value chain and concentrating on niche areas of software development, Australia can use its innovative and creative skills to maintain and grow a world-class software sector that draws on the low cost inputs of other countries.

Though this report is about SQA, it highlights that SQA is just one of four key considerations for Australia to grow its local software industry and compete on the world stage:

- Innovation—the importance of this must be recognised, including that Australia is world class in niche areas where it has significant ‘domain experience’. To maintain this edge requires continual investment in R&D and encouragement of innovative SMEs.
- Software process improvement (SPI)—is a necessary commitment for producing competitive software. This is especially important for SME’s who may not have or follow rigorous processes.
- Software quality accreditation (SQA) —should be facilitated where it is mandated, e.g. defence, or is a barrier to enter a particular market.
- Business acumen—needs to be emphasised, including the discipline of Continuous Business Process Improvement.

This report recommends action by both industry and Government in the above four areas to accelerate Australia’s growth and competitiveness in the world software industry.

1 Introduction

1.1 Background

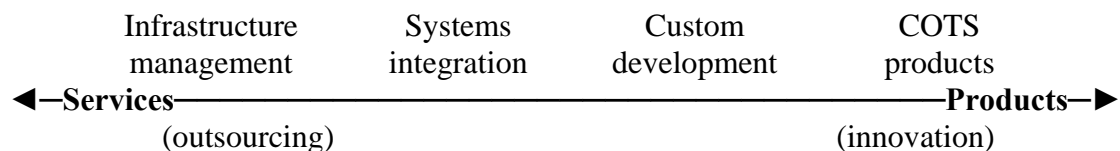
The Software Industry is different from other industries:

- It is pervasive—supplying tools and systems to every major industry across corporate, government and academia.
- It is diverse—covering everything from services (including consulting, systems integration and custom developments) to shrink wrapped (commercial off-the-shelf (COTS)) products.
- It is complex—with developments ranging from multifaceted components to extremely complicated distributed systems.
- It is growing—with continually expanding projections for revenue and employment.

Most importantly, the development of software covers a broad spectrum, generally including:

- Infrastructure management—e.g. installation, configuration, monitoring and maintenance.
- Systems integration—putting together of systems with many components.
- Custom developments—e.g. contract development for particular customers.
- COTS products— packaged products for the general market.

This spectrum can be illustrated as follows:



The left side of the spectrum is very much driven by cost. This has led the global community to turn to lower-cost offshore software services where the work can be well defined. This includes ‘mundane’ services such as IT maintenance and contract work that can be well defined. The outsourcing debate has mainly arisen because of the rise of such capabilities out of India, China, Southern America and Eastern Europe.

The middle of the spectrum is very much driven by process. Historically, contract software projects have sometimes experienced an undesirable combination of cost overruns, delays and disappointing functionality and reliability. Consequently, there is a lot of pressure to reduce commercial risk on large projects for particular customers. In order to improve software capability, reliability and predictability, and to reduce risk and delays, there has been a global trend towards standards of best practice for

software development. The Capability Maturity Model[®] Integration (CMMI[®]), developed by the Software Engineering Institute, Carnegie Mellon on behalf of the US Department of Defense, is one example of a prominent process improvement model. Note that these standards associate ‘quality; with ‘on time, on budget, with required functionality’ projects.

The right side of the spectrum is very much driven by innovation. COTS (packaged) products differentiate themselves by unique functionality and their ability to provide significant value by solving general business problems. Australian companies doing well on the world stage are generally those that have ‘clever’ products in niche areas. They are well-conceived, made, and marketed and often are capable of being adapted for particular customers, as demonstrated by the IT&e case study below.

FINDINGS

- Software can be differentiated on the basis of price, quality and functionality.
- Australia can best compete on functionality.

CASE STUDY— IT&e

Some SMEs are able to take advantage of Australia’s small IT market place by capitalising on their intimate knowledge of their purchasers’ IT challenges. Take IT&e for example.

IT&e has been able to move successfully from providing services to the financial sector into the development of COTS software product. IT&e developed an intimate working knowledge of the financial sector through a number of service engagements with many of Australia’s leading banks. Many of IT&e’s employees have worked for several years in both the IT and finance sector. IT&e was able to combine this knowledge and experience to identify a potential gap in the market—creating Razor, a comprehensive credit risk management package aimed at the global market. ANZ was IT&e’s first customer for the product—citing its superiority in exposure calculation as setting it apart from other international risk software products.

IT&e is now focussed on building its global presence. With credit risk management high on the agenda at most banks Razor is well-positioned to challenge some of the more established names in this market.

IT&e is currently scoping out further opportunities in the financial sector—by drawing on its understanding of the new, international finance sector regulatory standards associated with the BaselIII Framework.

In this environment software, while not the principal business activity for many organisations, has become a strategic and competitive differentiator among many business sectors. Therefore, software purchasers are becoming increasingly aware of the critical nature of their software systems and the need to ensure the reliability and

[®] Capability Maturity Model and CMMI are registered in the U.S. Patent and Trademark Office by Carnegie Mellon University.

integration of both packaged software and custom applications. Accreditation is one method being used by the software sector to address these issues, both as a means of internal process improvement and as a pure marketing tool.

These pressures on the global software sector are occurring at a time when the Australian information and communications technology (ICT) sector is recovering from the 'dot.com crash', but still facing intense international competition in the domestic market. In 2002–03 total income for all ICT specialists businesses was \$79.9 billion and the industry employed over 230 000 people. Of this, computer services (of which software related activities are a key component) employed over 105 000 people and generated revenues of \$17.0 billion. This strong computer services base is founded on opportunities in niche areas such as mining and key strengths including innovation and skills. There is also substantial software development in other ICT firms as well as in non-specialist ICT firms in all market sectors of the economy.

FINDINGS

- The Australian software industry is world class and dominates many high-end niche areas in the mining, financial services, aerospace, defence and e-security sectors.
- It has the potential to be world competitive in many other areas based on its key inherent strengths which include: innovative capacity; people skills; and educational quality.

Given the significance of the Australian software sector, the Government believes that it is important for key stakeholders to consider the potential impact of trends in software quality accreditation on its future development. To assist this process the Minister for Communications, Information Technology and the Arts announced on 8 June 2004 the establishment of a Software Quality Accreditation Working Party.

1.2 Working Party

The Working Party was selected to provide a wide range of expertise on software quality and to ensure appropriate stakeholder representation. Membership was as follows:

- Professor Ross Jeffery (Chair): University of NSW / NICTA
- Mr Ron Davenport: Software Engineering Australia
- Mr Rob Durie: Australian Information Industry Association
- Mr Gary Ebeyan: Infosys
- Mr Chris Felstead: GE
- Mr Prasad Guntupalli: Birlasoft
- Mr Bob Hart: Australian Computer Society
- Mr Rick Harvey: Computer Associates
- Dr Andrew Lucas: Agent Oriented Software

- Mr Ashley Mahar: Geometry
- Mr David Smith: ANZIT-IB
- Ms Angela Tuffley: Software Quality Institute, Griffith University.

The Working Party was provided with secretariat support by the Department of Communications, Information Technology and the Arts (DCITA).

1.3 Terms of Reference

The terms of reference for the Working Party are:

The Software Quality Accreditation Working Party will advise the Government on the importance of software quality accreditation in helping Australian software firms to win business, particularly in large scale international projects, and will examine software improvement and accreditation processes and costs, as well as options for addressing these issues. The Working Party will report by 31 October 2004.

The Working Party report will cover the following issues:

1. The extent to which software quality accreditation is important in assisting Australian software companies to win business, in particular business from overseas.
2. The types of software quality accreditation that are available, the processes and time required for accreditation and the costs (including management costs, particularly for SMEs) of accreditation.
3. A stocktake of software firms accredited in Australia and to what levels under the various available systems, including the relationship between accreditation and company size.
4. A comparison of level of accreditation of software firms in Australia and overseas.
5. The identification of potential actions to address any issues in this area.

1.4 Definitions

During the Working Party's considerations it became clear that key terms such as quality, process improvement and accreditation are often defined in context and viewed differently by different stakeholder groups.

1.4.1 Quality

'Quality' is a loosely used term. Essentially it is about a customer's perception about a product or service. This encompasses factors such as fitness for purpose, meeting expectations, being free from defects, behaving as documented, and value for money. Two stakeholder perspectives on quality are as follows:

- Software developer – defined hierarchically as a set of characteristics and sub characteristics such as functionality, usability, efficiency, maintainability, portability and so on.
- Software customer - characterised by the factors of support, usability, functionality, operation, economics and supplier.

1.4.2 Process improvement

Process improvement is a discipline in which an organisation commits to (continually) improving the management, definition, control and optimisation of its practices and procedures. The benefits include a reduction in defects, efficiency of production and repeatability of result.

There is a marked differentiation between process (how something is built) and innovation/functionality (what something does). In particular, excellence in process does not necessarily mean excellence of product or service.

1.4.3 Accreditation

Software Quality Accreditation is a formal process whereby a third party makes a formal assessment of an organisation’s processes against a given standard.

There are many different accrediting organisations, many different quality standards and often many different grades of assessment. This means that the promotion of an accredited capability should always be qualified by what was accredited, when, how and by whom.

FINDING—SQA provides formal recognition by a third party of the state of the software processes within an organisation at a given point in time.

1.5 Accreditation in context

In addition to definitional clarity, the Working Party believes it is also important to recognise that software quality accreditation should not be seen as an end in itself. Rather it should be viewed as one potential means to implementing software process improvement and from there broader business process improvement.

Formal software quality accreditation is potentially also only relevant to particular sub-segments of the Australian software sector where it is a demand driven barrier to entry (e.g. mandated in a key sector such as defence), or a key marketing differentiator.

Software quality accreditation, therefore, should not be seen as some form of panacea for the Australian software sector. However, the process improvement steps that form the basis for software quality accreditation can contribute to overall business improvement if tailored to support overall business objectives and implemented in a committed and sustained manner.

FINDING—Competitiveness requires broad business process improvement.

RECOMMENDATION—Government and Industry work towards promoting Australia as a source of high quality innovative software which values continuous software process improvement rather than just accreditation.

1.6 Methodology

The analysis, findings and recommendations of this report are essentially based on the individual and collective expertise of the Working Party members. Drawn from a wide cross section of the Australian information and communications technology (ICT) sector, the Working Party drew on software quality expertise from the education, research and industry (small-to-medium enterprises (SME) and multinational) sectors. In addition, it included representatives from the key industry associations and bodies advancing the issue of software quality and associated accreditation in Australia.

To support the considerations of the Working Party the Secretariat reviewed key reference sites and material which are listed in [Appendix 1](#). In addition, the Secretariat conducted a limited number of indicative stakeholder interviews to test the assumptions of the Working Party. A list of the organisations interviewed is at [Appendix 2](#).

2 Importance of SPI and accreditation

TOR 1 The extent to which software quality accreditation is important in assisting Australian software companies to win business, in particular business from overseas.

The concept of benchmarking organisations for the quality of their software development practices emerged in the United States in the late 1980s when the Software Engineering Institute at Carnegie Mellon developed the Capability Maturity Model (CMM[®]) for the United States defence sector. Adoption spread to the broader software industry in the 1990s, for example when Indian companies used CMM accreditation to gain entry to the US IT services outsourcing market. In Australia similar forces were at work, but interest in software quality accreditation as an issue of industry competitiveness became particularly prominent when Telstra announced a proposed goal of CMM Level 5 for relevant suppliers in June 2003.

The importance of accreditation to the competitiveness of Australian companies will depend on their specific circumstances and the markets in which they operate. Achieving a level of maturity against the CMM[®] is mandatory in the defence sector in the United States and the United Kingdom. In addition, Australia is adopting a staged system of capability maturity criteria under its Defence Electronic Systems Sector Strategic Plan. In the IT services sector large organisations require their suppliers either to hold formal software quality accreditation or, increasingly, to be able to demonstrate similar software process capability. However, there is growing evidence that large acquirers of software services are looking beyond the badge of software quality accreditation to the underlying software and business process capabilities of their suppliers.

In such an environment it is important to recognise that widespread mandating of particularly accreditations can not only be inappropriate, but also counter-productive. It is the underlying software processes and models used that are important, not the stamp of accreditation which can only ever be indicative. In addition, accreditation may impose unnecessary costs on suppliers, particularly SMEs, and create unintended barriers to entry.

FINDING—Mandating a particular SQA can have unintended detrimental effects on the industry.

RECOMMENDATION—Governments to work in conjunction with industry to implement a coordinated policy to accelerate SPI as a means of strengthening the Australian software industry. However, accreditation should not be mandated by business or government without careful consideration.

2.1 Improved software processes

Software now pervades every major sector of the economy and software process improvement is of importance to all organisations, but the business drivers for

[®] CMM is registered in the U.S. Patent and Trademark Office by Carnegie Mellon University.

adopting SPI vary and can include risk management of an organisation's dependence on key data, productivity or quality assurance of software development.

A viewpoint of software developers was captured in a 2003 Software Engineering Australia (SEA) study of software industry professionals who subscribed to its journal *Software*. Issues of major concern with developers were delivering software on time, on budget and with the required functionality and securing sufficient time and resources for testing software during the development cycle. Improvements in these areas are cited by both large and small companies as the benefits of software process improvement methodologies.

CASE STUDY—GEOMETRY

Geometry is a small Australian Software development company that chose to participate in a pilot study of SEA's SoftwareMark® product (see Section 3.4). The company was motivated to participate in the pilot because it was keen to improve its productivity levels and also to undertake international benchmarking. The SoftwareMark program was seen as attractive because it was focussed on small companies, it was subsidised by the Australian Government under the Intelligent Island Program and its scope was broader than the more generic ISO standards.

Geometry has identified a range of benefits from participation in the pilot and attaining SoftwareMark® Silver accreditation, including: linking of corporate objectives to all project activities; confidence and clarity in project management; and clearer performance expectations for staff. The most dramatic improvement for Geometry has been the improved experience of its customers. Clients appear to value accreditation, but more specifically they value the concept of process improvement and the associated positive effects on service delivery.

FINDING—Well implemented SPI helps produce quality software.

RECOMMENDATION—Key industry stakeholders (ie ACS, AIIA, Engineers Australia, NICTA, SEA and SQI) actively endorse, promote and facilitate greater SPI usage, particularly by SMEs.

2.2 Contribution to broader business improvement

The same SEA study of its subscribers indicated that a variety of software process improvement and project management methodologies are being used by companies. This variety was also articulated in the interviews undertaken with stakeholders by the Secretariat to the Working Party. Recent media focus on CMMI has led many purchasers and providers to look more closely at this methodology. However, there was a clear message from all interviewed that 'we need CMMI to work for us; we don't want to work for CMMI' and the methodology was frequently used in conjunction with other business and project management tools. All types of process improvement methodologies are seen by purchasers and providers of software to be beneficial to business. Growing awareness of accreditation and methodologies in the media and amongst industry players is driving greater acceptance of formal improvement schemes within companies.

CASE STUDY—RAYTHEON AUSTRALIA

Raytheon Australia is a prime contractor for the Defence Materiel Organisation (DMO). It manages the delivery of large, highly complex Mission System Integration projects. This includes systems architecture, systems integration and Supply Chain Management aspects of the projects. Each project currently has a quality plan and projects are managed using Integrated Project Teams (IPTs), which includes representatives from all process areas – software development, systems engineering, finance, quality and the customer. Raytheon currently holds accreditation for ISO9000, but achieving CMMI accreditation is now a priority. DMO is Raytheon Australia's sole customer and competitors are currently seeking accreditation. The perceived benefits of achieving CMMI accreditation are associated with improvements in project management, accurate tendering, risk reduction, and the ability to gather metrics, and to perform continuous improvement in all areas of the business. The complementary nature of CMMI and the Australian Business Excellence Framework have been identified and perceived as advantageous.

FINDING—A key to quality and competitiveness is continuous process improvement.

2.3 Reduced costs

While the upfront costs of SPI improvements and associated accreditation (where appropriate) can be high, there appears to be adequate evidence that these costs can be more than recouped by long-term improvements to software development and business processes that improve internal organisational dynamics and enhance customer service delivery. Therefore, the Working Party believes that where SPI is implemented appropriately the benefits can far outweigh initial implementation costs. However, it is recognised that these initial costs, particularly where they are tied to some formal accreditation process, can be a barrier to SMEs.

CASE STUDY—4LOOP

Some large companies acknowledge that there are small providers already operating with superior business and software improvement processes in place – some of these are accredited, some are not. 4LOOP is an example of a successful firm which is not accredited.

4LOOP is a small company specialising in building innovative solutions to complex e-business requirements, but it does not have any formal accreditation. The company was established at the time of the dotcom crash and has built its business case on its tailored solution delivery methodology—winning business and delivering solutions to significant purchasers such as Hewlett-Packard, Pioneer and Toyota.

In a tight market where revenue comes from fixed-cost projects, 4LOOP has been able to use its internal methodology to consistently deliver on time and within budget with extremely low post-delivery maintenance costs. During the initial stages of project development 4LOOP's clients can find its detailed information gathering and specification process surprising and demanding. However, when solutions are

delivered, on time, as specified and within budget, many clients have indicated an improved understanding of the value of the methodology to the purchaser. 4LOOP attributes its ability to develop a viable business in this tight market to its strong methodological base.

2.4 Access to specific markets segments

Anecdotal advice from Australian purchasers and providers (ranging from multinationals to SMEs) indicates that accreditation and process improvement methodologies are increasingly on the agenda of acquirers – during the initial stages of choosing a provider, and also during the delivery phase of projects. Purchasers, in both the private and public sector, use a variety of devices for incorporating accreditation and methodology into the business relationship:

- Some acquirers have mandated accreditation or standards as a prerequisite to doing business. Within this category there are two groups:
 - Organisations that will deal only with providers that already have accreditation (eg. Telstra’s large outsourcing contracts).
 - Organisations which choose their providers on the basis of other factors, but which require accreditation before finalizing a delivery agreement (See Agent Oriented Case Study below for an example of how this works in the high end niche market of the defence sector).
- Other acquirers incorporate achievement of accreditation and/or demonstrated methodology into project milestones.

CASE STUDY—AGENT ORIENTED SOFTWARE PTY LTD

This company develops intelligent software agents that can be embedded in control systems. These agents have a variety of applications, such as operating life support systems in the health sector, and providing autonomous unmanned aircraft for the defence sector. This technology is highly innovative and focused on niche markets.

After several years of perseverance Agent Oriented has recently been successful in securing a significant contract with the British Ministry of Defence. In order to deploy this intelligent software on an aircraft, Agent Oriented must have its technology formally assessed in accordance with the British Ministry of Defence Standard 0055 Safety Critical. This standard focuses on the safety of the product in its environment of application.

Agent Oriented is also currently involved in establishing projects with the US Department of Defense (DoD). It is expected that the US DoD will require compliance with RTCA Do178B, the standard for software development process in the United States aerospace industry for safety critical systems.

Agent Oriented Software is also bidding into major international defence programs (eg the Joint Strike Fighter), where ISO9000/TickIT accreditation would be needed.

2.5 Market differentiator

Accreditation can be used a market differentiator, as suggested by large outsourcing contracts going offshore to companies that have achieved CMMI maturity levels. However, discussions with stakeholders indicate that accreditation can be a relatively shallow indicator of quality, unless coupled with a deeper understanding of the specifications and capabilities associated with project delivery. Several large purchasers, including Telstra and DMO, appear to be developing procurement strategies that take into account this complexity when assessing vendors.

3 Types of software quality accreditation

TOR 2 The types of software quality accreditation that are available, the processes and time required for accreditation and the costs (including management costs, particularly for SMEs) of accreditation.

There are a number of different quality systems used by the software and systems integration industry around the world for accreditation purposes. The more widely used systems are as follows:

- ISO 9001 and related industry specific standards based on it
- ISO 15504 (SPICE)
- Capability Maturity Model Integration(CMMI) and its predecessor, Capability Maturity Model (CMM)
- TickIT (United Kingdom and Sweden)
- in Australia, SoftwareMark (based on CMMI).

In addition, particular industries may well require software to conform to an operational or safety standard relevant to that sector. An example is the RTCA DO178b standard for the aircraft industry, which governs the development processes used in the production of airborne software.

FINDING—There are many SPI methodologies, each being a collection of best practices.

3.1 ISO 9001

The ISO 9000 series is a family of quality standards of which ISO 9001 is the primary and the most widely used. The ISO 9000 family of standards are generic models although software specific ones have emerged. ISO 9001 was developed to create an internationally uniform and recognizable set of quality management system requirements. ISO 9001 is for organisations involved in design, development, manufacturing, service, installation, distribution, and research & development. It lays a foundation for necessary procedural standardisation and creation of maintainable systems for process documentation to reduce variability. Although it is a product/service conformity model, detractors accuse ISO 9001 of being hardware oriented. The major elements of ISO 9001 are:

- quality management systems
- management responsibility
- resource management
- product realisation
- measurement, analysis and improvement.

Some of the main industry specific standards based on ISO 9001 are:

- QS 9000 & TE 9000 - Automotive specific

- AS 9000 - Aerospace specific
- TL 9000 - Telecom industry specific
- ISO 9000-3 guidance on ISO 9001 for software companies
- TickIT- a United Kingdom program applying ISO 9001 to software organisations.

ISO 9001 has been adopted and recognised by over 75 countries. While the focus of the previous versions was on defects and products, the focus of the new version ISO 9001-2000 is directed at customer satisfaction and continuous improvement.

3.1.1 ISO 9000-3 (Family of ISO 9000)

The ISO 9000 series software development process standard was coined out of the need to document the process involved in developing software products. It is based on quality and process management of software products. In addition, the standard sets out guidelines for the various stages of software development via testing to maintenance, and identifying minimum requirements for quality systems. The purpose of the ISO 9000-3 series is to deal with quality management and quality assurance standards to provide guidelines for the application of the ISO 9001 standard to the development, supply and maintenance of software.

- The guidelines are intended to provide guidance where a contract between two parties requires the demonstration of a supplier's capability to develop, supply and maintain software products.
- The guidelines are very applicable in contractual situations for software products when the contract specifically requires design effort and the product requirements are stated principally in performance terms, or they need to be established, and to build up purchasers' confidence by having an adequate method of assessing supplier's capabilities in development, supply and maintenance.

3.2 ISO 15504 (SPICE)

In June 1991, the ISO/IEC JTC1/SC7 initiated a study on the need for a software process assessment standard. The results of this study drove the establishment of the Software Process Improvement and Capability dEtermination (SPICE) project, which was started in 1993 to standardise and improve on the existing software assessment methodologies. The SPICE project is developing the ISO/IEC 15504 Information Technology: Process Assessment standard to address the capability of processes involved in software acquisition, development, operation, supply, maintenance, and support and is aligned closely with ISO/IEC 12207:1995 Amd 2 Software Life Cycle Processes.

The ISO/IEC 15504 standard is a measurement framework describing the capability measures common to each process. In determining the capability of organisational processes, there are six levels defined with nine process attributes (generic practices). An organisation's assessment provides a rating of the highest capability levels achieved for the processes assessed. Thereby, it succeeds in giving a profile of process capability for the organisation.

SPICE has a number of strengths, including being relatively inexpensive and, therefore, more easily applicable to small firms and being able to evaluate individual processes. Its weaknesses include that it does not set priorities for improvement in an organisation, nor does it define a route for improvement as CMMI does.

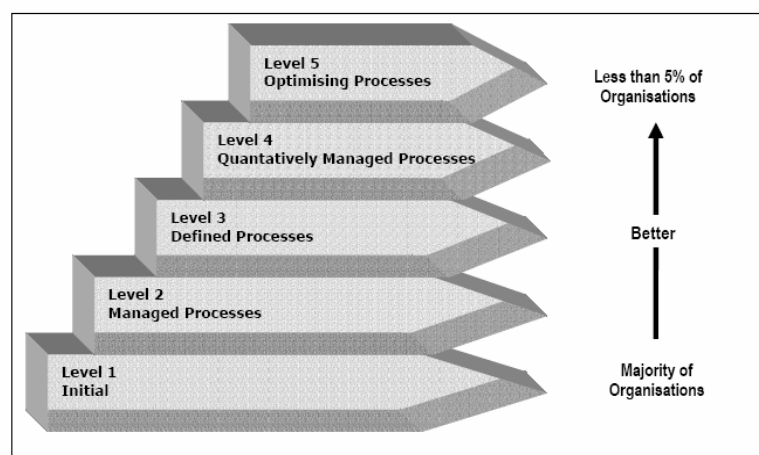
3.3 CMMI (CMM)

The Software Engineering Institute (SEI) at Carnegie Mellon University in Pittsburgh was sponsored by the US Department of Defense to improve the practice of software engineering. Their key effort was the development of the Capability Maturity Model (CMM) which was developed and published in 1993. CMM was an immediate success in terms of its wide acceptance by the software industry. Essentially CMM is a process improvement model for software development. It provides the roadmap and provokes the questions which should be asked along the path to software development but does not provide the answers as to how the development should be progressed.

CMMI is a recent development, which was borne out of a 1997 review of Software Engineering Institute activities by the US Under-Secretary of Defense for Acquisition and Technology. A team of both US industry and Defense representatives decided to develop an integrated framework for maturity models and associated products which became known as CMMI. The purpose of CMMI is to provide guidance to improve efficiency, return on investment and effectiveness of process improvement efforts by organisations using models that integrate such systems as engineering, software, process and project management and support functions. CMMI fits proven practices into a structure that helps an organisation assess its organisational maturity or process area capability, establish priorities for improvement and implement these improvements.

CMMI provides guidance for improving an organisation's processes and ability to manage the development, acquisition, and maintenance of products and services with the main focus on systems engineering and software engineering. CMMI has five distinct levels of maturity that provides a set of best practices that address productivity, performances, costs, and stakeholders' satisfaction, which are defined in Table 1.

Table 1



Alan Abrahams, 'CMMI Report for Victorian Government', January 2004, p.7.

CMMI covers both systems and software engineering within its scope and focuses on:

- long-term viability rather than short-term project and contractual issues
- establishing a strategic business plan
- providing and protecting resources for long-term improvement of the organisation's processes.

3.3.1 Specific benefits and costs

CMM has been in commission for over ten years and there is significant research on the types of gains that are capable of being achieved. A recent analysis of CMMI based process improvement in a number of organisations found the following benefits:

- 33 per cent decrease in the average cost to fix a defect (Boeing Australia)
- 30 per cent increase in software productivity (Lockheed Martin Management & Data Systems)
- 5:1 return on investment for quality activities (Accenture)
- 13:1 return on investment calculated as defects avoided per hour spent in training and defect prevention (Northrop Grumman Information Technology).

A mature development process can mean greater productivity and predictability, with reduced project risks that aid client perception of the organisation as being disciplined, knowledgeable, reliable and trustworthy. It has been suggested that organisations operating at CMM maturity level 3 are 65 per cent more productive than those at maturity level 1, and they reduce cost and schedule by 20 per cent and deliver 80 per cent fewer defects.

CMMI is considered to be one model of best practice covering Process Management, Project Management, Systems and Software Engineering, Integrated Product and Process Development, Acquisition Management and Support Functions. It can guide an organisation in improving its processes and ability to manage the development, acquisition and maintenance of products and services. CMMI can also assist in understanding the capability of potential suppliers to consistently deliver services and/or products.

For companies that began their CMM based SPI efforts in 1992 or later, the median time to move from:

- Maturity Level 1 to 2 is 22 months
- Maturity Level 2 to 3 is 21 months
- Maturity Level 3 to 4 is 25 months
- Maturity Level 4 to 5 is 15 months.

CASE STUDY—ANZIB-IT

On 31 October 2003 ANZIB-IT became the first organisation in Australia, and the second bank in the world, to be assessed as a Capability Maturity Model Level 5 organisation. ANZIB-IT decided to undertake a CMM Level 5 appraisal because it wanted to ensure its processes were as good as expected and to actively undertake the challenge of improving processes.

The actual assessment itself took two weeks and involved 30 staff interviews, each of 2–3 hours duration. The direct lead-up to the assessment was about four months, but preparation began with management making the conscious effort to improve processes in 1999. It was at this stage that a project office was established with a review committee.

The focus was on improving project management techniques. Progress was monitored and records kept of all decisions and processes. Collectively this resulted in three years of historical data that served as preparation material for the CMM Level 5 appraisal. The decision to pursue formal CMM accreditation was made in 2003. A reward scheme and staff teams (e.g. process improvement teams) were established to keep staff interested and involved. A total of 35 staff were involved in the project.

This was the first attempt at CMM Level 5 by the ANZ, but the bank did commission a mini-assessment report in 2000. This identified its strengths and weaknesses and formed the basis of the improvement plan.

The process cost a total of about \$1.4 million. This figure covers an eight-month period and includes the cost of anyone spending time on process improvement. It also includes the cost of the actual appraisal, which was \$130 000 in total.

FINDING—The cost of SQA can be a barrier for SMEs.

3.4 SoftwareMark®

Designed specifically for software developing SMEs and scalable to assist larger organisations, the SoftwareMark® Program provides software developing organisations with a means to improve their business and software development processes and to achieve independent, objective recognition for their level of software engineering and business expertise via SoftwareMark® certification.

- **SoftwareMark® Bronze** represents a company officially registered with SEA that has undertaken a benchmarking appraisal.
- **SoftwareMark® Silver**—achievement of at least 80 per cent of CMMI® Level 2 and at least 70 per cent of the required categories in the business analysis.
- **SoftwareMark® Gold**—achievement of at least 80 per cent of both CMMI® Level 3 and the required categories in the business analysis.

FINDING—There are many different forms of SQA that are not incompatible with each other (e.g. ISO 9001:2000 and CMMI).

3.4.1 Specific benefits and costs

The SoftwareMark® Program includes the following products:

- Software Process Spot Check - 1/2 day - \$625
- Introduction to CMMI® Seminar - 1 day - \$2 000
- Business Processes Appraisal - 1 day - \$2 000
- Software Processes Appraisal
 - CMMI® Level 2 Class C - 2 days - \$3 000
 - CMMI® Level 2 Class B - 6 days - \$18 000
- Improvement Report - 2 days - \$6 000
- Training - Typically 1 day per course – Cost varies
- Portal - Free online SPI & BPI assistance for SoftwareMark® companies

SoftwareMark®'s claimed benefits include:

- ensuring software development processes are reliable, predictable and repeatable
- improving the bottom line through increased efficiencies
- assisting in attracting new business
- helping to retain and attract good staff
- involving a company in a peer group of excellence—to build business networks
- increasing the level of professionalism and capability to work with international clients
- benchmarking an organisation's capabilities in line with globally recognised methodologies
- mapping process improvement paths for increased operational efficiency.

4 Software quality accreditation

TOR 3: A stocktake of software firms accredited in Australia and to what levels under the various available systems, including the relationship between accreditation and company size.

4.1 The software sector in Australia

Before looking at the levels of software process improvement methodologies and associated accreditation in Australia, it is important to have some understanding of the nature of the Australian software sector as this can impact on the usage of accreditation.

The Australian ICT sector is basically broken down into four broad groupings by the Australian Bureau of Statistics (ABS): manufacturing; wholesale trade; telecommunications; and computer services. In 2002–03 there were in total 23 950 ICT specialist businesses employing 235 696 people (107 686 ICT employees) in Australia. Total income for all ICT specialist businesses in 2002–03 was \$79 894 million (ICT income of \$74 692 million).

Specialist software producers fall within the ABS industry grouping of computer services which is a key component of the overall ICT sector, particularly with regards to number of business and employment. This grouping consists of the following sectors: data processing; information storage and retrieval; computer maintenance; and computer consultancy. In 2002–03 the computer services sector was reported by the ABS as consisting of 19 307 businesses employing 107 094 people (79 286 ICT employees). Total income in 2002–03 for the computer services sector was \$16 993 million (ICT income of \$16 116 million). There is also substantial software development in other ICT firms as well as in non-specialist ICT firms in all market sectors of the economy.

Computer consultancy dominates the computer services sector with 18 524 businesses and 99 574 employees (74 434 ICT employees) in 2002–03 and total income in 2002–03 of \$15 935 million (ICT income of \$15 099 million). Within computer consultancy the key sources of income are customised software services and solutions (\$3 959 million), other computer consultancy services (\$4 266 million), and software maintenance services (\$1 764 million).

In terms of industry structure the computer services sector is dominated by small businesses (<20 employees), although employment is fairly evenly split between small businesses and medium to large business (>20 employees). A detailed breakdown is provided in Table 2.

Table 2 – Structure of Computer Services Sector (2002–03)

	0-4 persons	5-19 persons	20-99 persons	100 or more persons	Total
Businesses	16 377	2 378	480	72	19 307
Employment	30 301	21 799	17 433	37 461	107 094
Total income (\$m)	2 668	2608	2904	8 813	16 993

With regards to geographic distribution, the computer services sector is primarily based in New South Wales and Victoria. A breakdown of number of business and employment by State/Territory is provided in Table 3.

Table 3 – Computer services sector by State/Territory (2002–03)

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT
Businesses	8 415	6 042	2 339	869	1 260	156	76	922
Employment	43 893	32 601	10 399	7 111	6 381	732	544	5 434

In the area of trade, there is a trade surplus in computer services. In 2002–03 there was an overall trade deficit in ICT goods and services of \$10 490 million. However, income from the provisions of computer services generated exports of \$1 071 million against imports of \$929 million.

FINDINGS

- The Australian software industry is multi-faceted and is characterised by large numbers of very small companies.
- The general areas are commercial off-the-shelf (COTS) product, custom software development, and services (integration and consulting).
- SPI and SQA approaches will vary in importance across these areas.

4.2 Awareness and use of SPI

Information currently available on the use of software process improvement methodologies in Australia and associated accreditation levels is fragmented and incomplete. The Working Party was unable to accurately ascertain the actual levels of SPI use and accreditation in Australia.

FINDING—Data on SQA is scarce, general in nature, selective and incomplete.

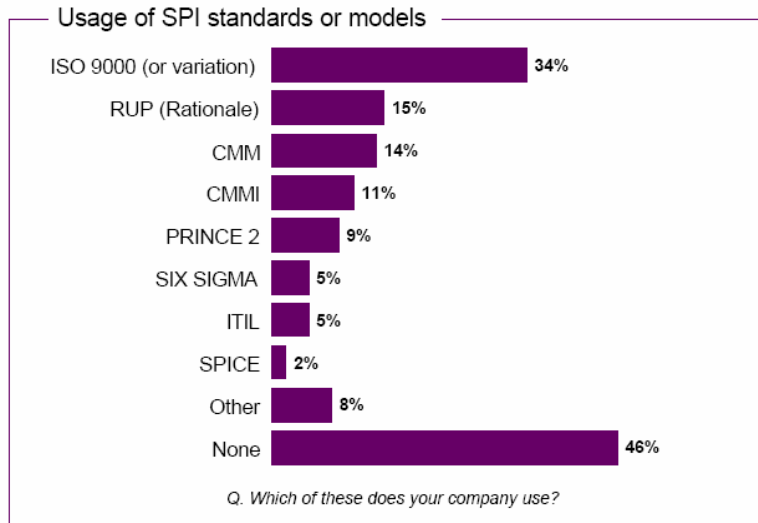
RECOMMENDATION—Industry stakeholders and Government to work together to collect data which monitors and benchmarks SPI performance and progress.

However, based on the indicative data available the Working Party believes that ISO 9001 and CMMI/CMM are the dominant methodologies in use, with CMMI/CMM typical undertaken by larger companies (although the recent SoftwareMark® is specifically targeted at SME needs) and ISO 9001 being used by both large and small firms.

FINDING—Organisations of any size can implement SPI.

The conclusion that ISO 9001 and CMMI/CMM are dominant is supported by a report research released last year by Software Engineering Australia based on a survey of more than 500 subscribers to SEA's *Software* publication (see Table 4).

Table 4



SEA, 'What's Bugging the Australian Software Industry', 2003, p.26.

While the SEA figures possibly overstate the overall industry usage of software process improvement (being based on a sample of people who have already shown a potential interest), they clearly indicate the:

- dominant SPI strategies/models (ISO 9000 variations 34 per cent and CMM® /CMMI® 25 percent)
- significant number of organisations that do not use SPI (46 per cent).

FINDING—SMEs do not appear to generally recognise the need for SPI or understand how to implement it appropriately.

RECOMMENDATION—NICTA, DMO, SEA and SQI jointly establish a SPI knowledge base to assist SMEs better understand organisationally appropriate SPI and SQA.

The respondents to the Working Party's stakeholder interviews also identified a variety of strategies/models, with ISO9000 (or variations) being the most common and CMM/CMMI also having a reasonably high profile. Anecdotal advice from Australian purchasers and providers indicates that a number of organisations employ a variety of well known and less known methodologies to manage software process improvement, project management and business processes. Some providers suggest that this 'hybridising' of methodologies enables them to streamline their approach to continuous improvement—'making the methodologies work for us, rather than vice versa'.

Discussions with stakeholders also indicated that Australian universities are increasing and refining their commitment to including software process improvement in the education of their undergraduate and postgraduate students. Maintaining this commitment has the potential to improve the uptake of software process improvement in business over time. Purchasers and providers have indicated that they would value the inclusion of software process improvement, business process improvement,

project management and accreditation in undergraduate curriculum, and that students that have received this education can have a competitive advantage over their peers.

4.3 Stocktake of current accreditation

4.3.1 CMMI/CMM

While companies are not under any obligation to publicly report CMM/CMMI appraisals, SEI does publish figures on the number of appraisals that are reported to it. In the case of Australia, a total of 35 CMM appraisals have been reported to SEI for the period 1987 to June 2004. SEI reported that Australian organisations had achieved CMM level rating of Levels 1 through to 3 and 5. This figure compares with a reported total of 27 CMM appraisals for Australian organisations for the period 1997 to June 2002.

Organisations that are using CMM/CMMII and have publicly stated the fact include the Australian Centre for Unisys Software (ACUS), ANZIB-IT, Boeing Australia Ltd, HP Australia, IBM GSA - Applications Management Services, Infosys Australia, Motorola Australia, Telstra, Tenix Defence, and Thales ATM.

4.3.2 Softwaremark®

Software Engineering Australia reported that at the end of October 2004 29 companies had participation in elements of the SoftwareMark® Program:

- Software Process Spot Check: 11 companies
- Software Processes Appraisal – CMMI® Level 2 Class C: 3 companies
- Software Processes Appraisal – CMMI® Level 2 Class B: 12 companies

4.3.3 ISO

The Working Party was not able to identify any documents which consolidated data on ISO 9001 accreditation by software companies in Australia. However, the Joint Accreditation System of Australia and New Zealand (JAS-ANZ) does maintain an online register (www.jas-anz.com.au/showpage.php) of all organisations that have been certified by a certification body which has been accredited by JAS-ANZ to perform such a certification. Through this individual software companies with ISO 9001 accreditation can be identified.

4.4 Inhibitors to Accreditation

While the level of formally SPI accredited companies in Australia may appear to be low, this does not necessarily impact on the overall competitiveness of the Australian software sector. The structure of the Australian software sector is such that it may have precluded the need for extensive levels of formal accreditation. In addition, companies can be implementing SPI methodologies without having formal accreditation by the relevant bodies of those methodologies.

However, in reviewing the issue of SPI accreditation in the Australian context, the Working Party did observe a number of potential barriers to Australian software companies implementing SPI and obtaining formal accreditation if desired.

Inhibitors to accreditation, and also SPI, exist on both sides of commercial relationships—purchasers and providers. Anecdotal advice indicates that there is huge variety in the capability of purchasers and providers when it comes to understanding the true value of software process improvement and accreditation. Some SMEs have strong methodologies in place, but have not committed to accreditation because the financial outlay involved does not make business sense.

FINDING—Organisations justify accreditation on commercial grounds, e.g. requirement to enter market and differentiation from other software suppliers.

Some evidence suggests that some SMEs do not have the skills, time, resources or management commitment to achieve either strong methodologies and/or accreditation. In this difficult environment, some purchasers and providers are taking on a leadership role with regard to software process improvement. Those organisations with a strong commitment to continuous improvement methodologies recognise that effective delivery can only be maximised when both purchasers and providers have a strong understanding of methodology. For example, the DMO is playing a leading role within its sector by developing a procurement strategy which supports the development of CMMI capabilities for both DMO and its providers over a period of time. Its approach is open to organisations which use hybrid methodologies, whilst simultaneously providing a framework for achieving CMMI capability and maturity over time if appropriate. This approach is presented in detail in the DMO’s recently released Defence Electronic Sector Strategic Plan.

CASE STUDY—THE DEFENCE ELECTRONIC SYSTEMS SECTOR STRATEGIC PLAN

The Defence Materiel Organisation (DMO) has developed a strategic approach to procurement – that will see it transition from ‘reactive assessment’ to ‘proactive specification’ of tenderers and current projects. DMO aims to clearly specify the capabilities required to produce customised products. These capabilities will become the eligibility criteria for tenders and the milestones for assessing effective delivery of current projects.

The CMMI framework will be used to determine key capabilities and to identify the ‘process maturity’ or performance level required. DMO has not mandated CMMI, but it does acknowledge that accreditation will play a quality assurance role, particularly where high levels of process maturity are required to manage risk. This means that providers can move towards accreditation in stages, as key capabilities and process maturity levels are identified and modified through dialogue with DMO.

This strategy aims to deliver benefits to both DMO and Australian industry. DMO will be able to deliver more effectively by providing clear specifications throughout the entire project life cycle. Australian industry will be in a position to invest in capability-building as a sound business decision (as it will be a decisive factor in eligibility for tender), there will be greater opportunity for companies to self-select

due to improved transparency, and there is likely to be a viable and continuous stream of work for those companies that demonstrate capability.

4.4.1 Cost

The management commitment of time and resources to accreditation is considerable regardless of the size of the organisation. A number of SMEs with sound processes in place and a strong understanding of software process improvement and the CMMI methodology estimated the cost of billing hours foregone in excess of \$100 000. One considered a similar annual commitment would be required to ensure the standard was maintained as a part of the organisation's culture. Although all were committed to high standards of process and quality and could see a commercial benefit to accreditation, they were unanimous that a strong market driver was necessary for the effort to be worthwhile.

In addition, the direct cost of formal accreditation can be significant, particularly at the higher levels of CMMI. For example, the ANZIB-IT group achieved CMMI Level 5 in October 2003 at a cost of \$1.4 million over eight months including the involvement of 35 staff and the appraisal cost of \$130 000.

4.4.2 Skills

A general lack of formal SPI skills in both existing employees and new recruits is viewed by the Working Group as being a potential key inhibitor to the increased uptake of SPI and associated accreditation. Stakeholders consulted commented that most new graduates lack process, systems engineering and systems integration skills. In addition, they observed that it is much easier to introduce SPI when younger recruits are familiar with process methodologies.

RECOMMENDATIONS

- ICT tertiary educators need to embed SPI as an integral component of software development.
- ACS and Engineers Australia undertake professional development activities to ensure that members in the software development industry are both capable of implementing and providing leadership roles in SPI/SQA.

4.4.3 Management commitment

Management commitment is also fundamental to the success of SPI given the resources required to implement it successfully. It is the more experienced and senior people within an organisation that must be engaged in introducing SPI to ensure internal cultural and process barriers are overcome to generate the potential benefits.

FINDING—Successful SPI requires strong commitment from management and professional capability in the organisation.

4.5 Accreditation providers (and processes)

There are a range of accreditation providers and processes relevant to the Australian software sector in both the domestic and international markets. These include:

- The Software Engineering Institute, Carnegie Mellon University provides CMMI appraisal services in Australia through licensed partners such as the Software Quality Institute (SQI) at Griffith University. Formal CMMI benchmarking requires a Class A appraisal by a team led by an SEI-authorized Standard CMMI Appraisal Method for Process Improvement (SCAMPISM) Lead Appraiser. There are currently five authorised SCAMPI Lead Appraisers in Australia.
 - Australian based organisations that can provide CMMI SCAMPI Class A appraisals services include SQI (Griffith University), Jacobs Sverdrup Australia, EDS Australia, S-3 Consulting and GPI. All these organisations can also provide CMMI Class B and C appraisals, with SQI and EDS also being authorised to deliver SCAMPI Class B and C appraisals.
 - Separate SEI authorisation is required to deliver the SEI 'Introduction to CMMI' courses.
 - There are approximately 250 SEI authorised instructors worldwide, but only a handful of these are in Australia. (SQI and Swinburne).
- SEA provides CMMI® Class B and Class C appraisals primarily for SMEs through the Softwaremark® initiative. SEA has three fully qualified and four partially qualified consultants to undertake these appraisals and conduct a CMMI® Overview seminar through a technology transfer with the European Software Institute (ESI). ESI is an SEI transition partner.
- TickIT is mainly supported by the United Kingdom and Swedish software industries and is complementary to ISO 9001. Certification is conducted by external quality assurance agencies. The process is administered by the International Register of Certificated Auditors (IRCA) with the support of the British Computer Society. (see www.tickit.org).

4.6 Support mechanisms

Australian governments have provided a range of assistance to improve software processes in the Australian software sector. While many of the dynamics of SPI and SQA are driven by market forces, the Working Party believes that further government support would be beneficial in ensuring appropriate take-up of SPI and SQA, particular by SMEs. Such support could include working with relevant industry associations/bodies to ensure industry is fully informed of SPI and SQA issues and could potentially extend to providing direct financial support, in particular for SMEs who may be facing SQA requirements as a barrier to specific export markets.

4.6.1 Australian Government assistance

SEA was established in 1997–98 under the Australian Government Software Engineering Quality Centres program to increase the competitiveness and technological sophistication of the software industry in Australia. SEA received seed

SM SCAMPI is a service mark of Carnegie Mellon University.

funding of \$23 million between 1997 and 2003, of which SEA National received \$14 million. SEA National continues to deliver software quality products as a self-funding not-for-profit organisation following the expiry of Australian Government funding in September 2003.

The Australian Government is also currently funding research on software process improvement and associated accreditation through its \$380 million support for National ICT Australia (NICTA) which has an empirical software engineering research program. As part of this program NICTA is undertaking collaborative work with SEA on the impact of Capability Maturity Model Integration (CMMI) software process improvement on SMEs.

4.6.2 State/Territory Government assistance

Victoria: The Victorian Government through Multimedia Victoria provides grants to assist Victorian small and medium-sized software businesses (fewer than 200 employees) to develop CMMI best practice in software development and business standards. The Government will refund up to 50 percent to a maximum of \$10 000, of the costs of achieving a CMMI level 2 rating. A number of companies have commenced the program.

Western Australia: The Software Mark Demonstration Project, a joint project between the Western Australian Government and SEA, is assisting 10 software companies in improving their business practices and achieving CMMI level 2 rating.

Tasmania: The Australian Government funded \$40m Intelligent Island Program supported 11 companies to undertake the initial pilot program for SEA's SoftwareMark. Based on a formal certification program, the program was designed to develop a core group of Tasmanian ICT SMEs who understand the value of major IT standards and have experience in developing the business processes required to implement such standards.

Queensland: The Software Quality Institute within the School of Computing and Information Technology at Griffith University was founded in 1990 with support from the Queensland Government. The Institute is concerned with the investigation of processes and standards for improving the quality of software, especially commercial, safety critical software. Techniques being investigated include the use of formal methods for specifying and deriving software, the experimental analysis of fault characteristics of current commercial software and the development of standards for software process assessment. Internationally, the Institute is one of only three centres chosen by the relevant ISO committee to develop such standards. Locally, the Institute serves as a focus for research, training, appraisal/assessment services and advice to industry and government on all issues of software quality. It has also been instrumental in transitioning CMMI technologies to Australia.

FINDING—Australian governments have the capability to accelerate the development of the Australian software industry through policy initiatives related to software quality.

RECOMMENDATIONS

- Governments to use existing programs or establish new initiatives to financially assist SMEs to implement recognised SPI methodologies.
- Governments to provide targeted grant assistance for SMEs to meet a particular SQA requirement that prohibits entry to key export markets.

4.6.3 Industry Bodies

Industry bodies such as the Australian Computer Society (ACS) and the Australian Information Industry Association (AIIA) are actively engaged in examining issues associated with software quality accreditation and its impact on the Australian software industry. For example, the ACS in October 2004 released a policy statement on software quality accreditation which can be found at www.acs.org.au.

5 Key trends

TOR 4: A comparison of level of accreditation of software firms in Australia and overseas.

5.1 Growing adoption of accreditation by suppliers

Available figures on formal accreditation levels internationally indicate that accreditation is increasingly recognised as a potential differentiator in the global software market.

- Of the 3360 CMM/CMMI related appraisals reported to SEI for the period 1987 to June 2004, 1035 occurred in the two years since June 2002.
- Of this total, there were 367 appraisals of the more recently introduced CMMI model reported to SEI for the period April 2002 (release) to June 2004. 267 of these CMMI appraisals were reported in the year to June 2004.
- For the TickIT program, there were 1093 active certificates across 44 countries as at June 2004.

While CMM/CMMI achievement is dominated by US-based appraisals, there are clear indications that it is being adopted in other regions such as Asia and Europe (see Table 5 for selected countries).

Table 5 - CMM/CMMI appraisals reported by country to June 2004

COUNTRY	CMM/CMMI	CMMI
Australia	35	<10
Canada	73	<10
China	182	16
France	135	<10
Germany	56	<10
India	359	44
Ireland	11	NA
Israel	30	<10
Japan	131	54
Korea	64	<10
Singapore	22	<10
UK	135	17
US	1896	170

TickIT, as a mainly United Kingdom based scheme, is dominated by UK companies, but does have some take-up in other regions. A breakdown of active certificate holders is as follows:

- United Kingdom 807
- Other European 131
- Middle/Near East 131
- North America 89
- India and the Far East 46

- Other (including Australia) 7

5.2 Increased demand for quality software

Organisations are increasingly demanding that software supplied to their business by in-house providers and/or external suppliers meet strict quality and cost requirements while improving business operations. This has seen software purchasers increasingly look to process methodologies to reduce the risks they face when installing, upgrading, or integrating software systems.

Accreditation is one means being used by purchasers to help address this issue, although some purchasers are more focussed on the actual SPI processes used rather than just the accreditation badge. Therefore, software developers will need to be attuned to the future SPI and/or accreditation requirements of their key customers to ensure these are adequately addressed by internal processes.

5.3 Increasing relevance to SMEs

As SPI and accreditation become more prevalent in the global software industry (through key trends such as global sourcing) and filter down the supply chain, SMEs will be increasingly required to demonstrate their software quality credentials. This could become a barrier to entry for SMEs in some markets.

In addition, SPI as a subset of broader business process improvement can be used by SMEs to improve their competitiveness and differentiate themselves to some extent in an increasingly crowded international market. However, for the Australian software industry, the Working Party believes innovative solutions combined with quality processes is the key to international success.

6 Consolidated listing of findings and recommendations

TOR 5: The identification of potential actions to address any issues in this area.

Throughout the text of the report the Working Party has put forward key findings and recommendations associated with its terms of reference. They are grouped here under relevant general headings to facilitate consideration.

6.1 Findings

6.1.1 AUSTRALIAN SOFTWARE INDUSTRY

- 1) The Australian software industry is world class and dominates many high-end niche areas in the mining, financial services, aerospace, defence and e-security sectors.
- 2) It has the potential to be world competitive in many other areas based on its key inherent strengths which include: innovative capacity; people skills; and educational quality.
- 3) Australian governments have the capability to accelerate the development of the industry through policy initiatives related to software quality.

6.1.2 SOFTWARE INDUSTRY CHARACTERISTICS

- 4) The Australian software industry is multi-faceted and is characterised by large numbers of very small companies.
- 5) The general areas are commercial off-the-shelf (COTS) product, custom software development, and services (integration and consulting).
- 6) Software process improvement (SPI) and software quality accreditation (SQA) approaches will vary in importance and application across these areas.

6.1.3 SOFTWARE QUALITY

- 7) Software can be differentiated on the basis of price, quality and functionality.
- 8) Australia can best compete on functionality.
- 9) A key to quality and competitiveness is continuous process improvement.

6.1.4 SOFTWARE PROCESS IMPROVEMENT (SPI)

- 10) There are many SPI methodologies, each being a collection of best practices.
- 11) Well implemented SPI helps produce quality software.
- 12) SMEs do not appear to generally recognise the need for SPI or understand how to implement it appropriately.
- 13) Successful SPI requires strong commitment from management and professional capability in the organisation.
- 14) Organisations of any size can implement SPI
- 15) Competitiveness requires broad business process improvement.

6.1.5 SOFTWARE QUALITY ACCREDITATION (SQA)

- 16) SQA provides formal recognition by a third party of the state of the software processes within an organisation at a given point in time.
- 17) There are many different forms of SQA that are not incompatible with each other (e.g. ISO 9001:2000 and CMMI)
- 18) Organisations justify accreditation on commercial grounds, e.g. requirement to enter market, and differentiation from other software suppliers.
- 19) The cost of SQA can be a barrier for SMEs.
- 20) Mandating a particular SQA can have unintended detrimental effects on the industry.
- 21) Data on SQA is scarce, general in nature, selective and incomplete.

6.2 Recommendations

6.2.1 LEADERSHIP

- 1) Government and industry work towards promoting Australia as a source of high quality innovative software which values continuous software process improvement (SPI) rather than just accreditation.
- 2) Key industry stakeholders (ie ACS, AIIA, Engineers Australia, NICTA, SEA and SQI) actively endorse, promote and facilitate greater SPI usage, particularly by SMEs.
- 3) Governments to work in conjunction with industry to implement a coordinated policy to accelerate SPI as a means of strengthening the Australian software industry. However, accreditation should not be mandated by business or government without careful consideration.
- 4) Industry stakeholders and Government work together to collect data which monitors and benchmarks SPI performance and progress.

6.2.2 FACILITATION

- 5) NICTA, DMO, SEA and SQI jointly establish a SPI knowledge base to assist SMEs better understand organisationally appropriate SPI and software quality accreditation (SQA).
- 6) ICT tertiary educators need to embed SPI as an integral component of software development.
- 7) ACS and Engineers Australia undertake professional development activities to ensure that members in the software development industry are both capable of implementing and providing leadership roles in SPI/SQA.

6.2.3 ACCELERATION

- 8) Governments to use existing programs or establish new initiatives to financially assist SMEs to implement recognised SPI methodologies.
- 9) Governments to provide targeted grant assistance for SMEs to meet a particular SQA requirement that prohibits entry to key export markets.

Appendix 1 – Key sources

Australian Bureau of Statistics. *Information and Communication Technology 2002-03*. 8126.0.

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Appendix 2 – Organisations consulted

Agent-Oriented Software Ltd

Dr Andrew Lucas - Managing Director

Australian Government Information Management Office

Steve Alford - General Manager

Beacon Group

Michael Kadoury - Corporate Counsel

Bluescope Steel

Wayne Saunders - Chief Information Officer

Defence Materiel Organisation

Australian Government Department of Defence

Directorate of Process Improvement

Mike Gibson - Director General

Jennifer Murray - Director

4LOOP

Sergio Tarza - Director

Mat Coolahan - Business Manager

Health Insurance Commission

Mark Fraser - Director, IT Services

Hewlett-Packard Australia

David Green - Senior Consultant

IdeaData

Rafi Sabel - CEO / Managing Director

IT&e Ltd – Financial Services Solutions

Cathy Dice

Multimedia Victoria

Ray Nicol - Manager (ICT Investment & Business Development)

NSW Department of State & Regional Development

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