

Applying Software Engineering Standards in Small Settings: Recent historical perspectives and initial achievements

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ABSTRACT

The software industry recognizes the value of very small enterprises (VSEs) in contributing valuable products and services. ISO International standards were not written for small projects, small development organizations, or companies with between 1 and 25 employees, and are consequently difficult to apply in such settings. Moreover, the current international Life Cycle Standards, ISO/IEC 12207 and ISO/IEC 15288, and their associated guides, do not explicitly address the needs of VSEs. This new international standardization project proposes to address some of those difficulties by developing profiles and by providing guidance for compliance with ISO software engineering standards such as ISO/IEC 12207 and ISO 9001.

Keywords: standards, software engineering, very small enterprise, ISO, agile standard.

Introduction

This paper presents a new project which proposes to facilitate access to, and utilization of, ISO (the International Organization for Standardization) Software engineering standards in very small enterprises (VSEs), a term which includes small software development departments and small projects within larger organizations. VSEs are typically organizations and projects with between 1 and 25 employees. In Europe, for instance, 85% of the Information Technology (IT) sector's companies have between 1 and 10 employees.² In the Montreal area, as illustrated in Figure 1, close to 80% of IT companies have between 1 and 25 employees³ (Laporte 2005). Another study conducted by the Technology Assessment Group (CITA) of Wallonia [1] has published similar data: about 60% of IT companies there have fewer than 5 employees. In Brazil, small IT companies⁴ represent about 70% of the total number of companies (Anacleto 2004). Finally, in Northern Ireland (McFall 2003), a survey reports that 66% of IT organizations within companies employ fewer than 20 employees. There is a need to help these organizations understand and use the ISO software engineering international standards.

The current ISO software engineering life cycle standards, ISO/IEC 12207 and ISO/IEC 15288, and their associated guides, are not easily applied in small settings. Compliance with those standards is difficult, if not impossible, for them to achieve.

¹ <http://www.logti.etsmtl.ca/profs/claporte>

² <http://www.esi.es/en/main/iitmark.html>

³ <http://www.montrealinternational.com/>

⁴ Brazil classifies companies with fewer than 10 employees as micro companies, and those with 10-49 employees as small companies.

Size (employees)	IT Companies		Jobs	
	Number	%	Number	%
1 to 25	540	78%	5,105	29%
26 to 100	127	18%	6,221	36%
over 100	26	4%	6,056	35%
TOTAL	693	100%	17,382	100%

Figure 1. Size of IT companies in the Montreal Area (Laporte 2005)

This paper is divided into four sections. In section 1, we briefly describe the ISO/IEC SC7 organization mandate in software engineering standards development. In section 2, we relate the recent history that led to an ISO/IEC SC7 Project Proposal for small settings. In section 3, we present the text of the final proposal tabled at the last ISO/IEC SC7 meeting. Finally, in the last section, we report on what was accomplished at a recent meeting in Thailand.

Section 1. Overview of the ISO/IEC SC7 mandate

During 1987, the ISO and the IEC (the International Electrotechnical Commission) joined forces and put in place a joint technical committee, named Joint Technical Committee 1 (ISO/IEC JTC1) with the following mandate: “Standardization in the Field of Information Technology: Information technology includes the specification, design, and development of systems and tools dealing with the capture, representation, processing, security, transfer, interchange, presentation, management, organization, storage, and retrieval of information.”[4] The mandate of sub-committee SC7, within JTC1, is to standardize processes, supporting tools and supporting technologies for the engineering of software products and systems.

Figure 2 illustrates the evolution of the over 90 published ISO/IEC standards that are the responsibility of SC7.

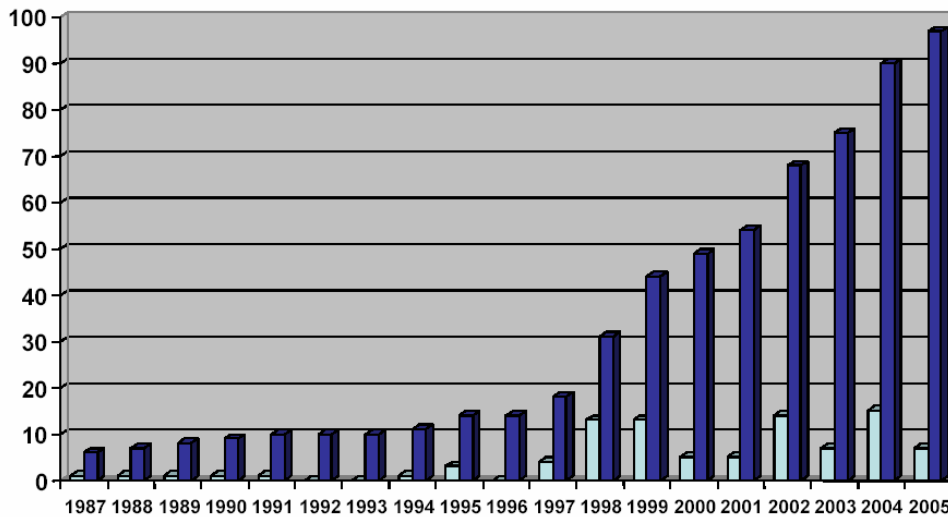


Figure 2. Evolution of published ISO/IEC Software and Systems Engineering Standards (SC7 2005)

Within the portfolio of SC7 standards, a number are grouped together in a category called “Software and Systems Engineering Processes”. These are standards describing good software and systems engineering practices, as well as standards assessing software and systems engineering practices. In this group, there are four key ISO/IEC standards:

- ISO/IEC 12207 Software Life Cycle Processes
- ISO/IEC 15288 Systems Life Cycle Processes.
 - Developed with the strong participation of the International Council on Systems Engineering (INCOSE).
- ISO/IEC 15504 Software Process Assessment series.
 - Capability Maturity Model[®] 5 IntegrationSM (CMMI[®]) is compatible with ISO/IEC 15504.
- ISO/IEC 90003 Guidelines for the Application of ISO 9001 to computer software.

The relationship between these standards is illustrated in Figure 3.

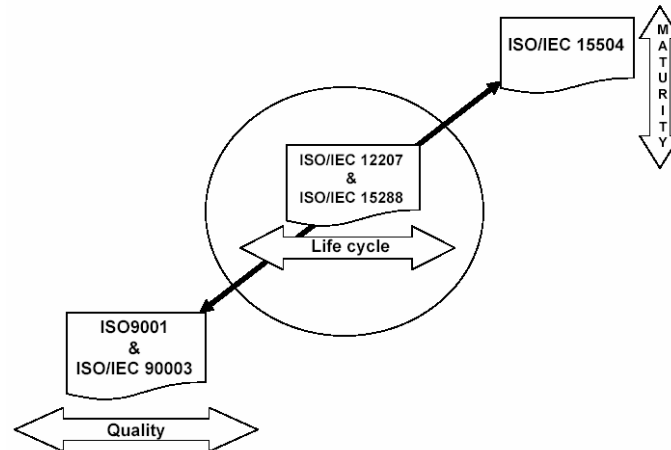


Figure 3. Relationship between key SC7 Standards (Coallier 2003)

These key standards are well known in the software and systems engineering community. Harmonization of those standards is always a topic of discussion and is included among the newest ISO/IEC SC7 work items. Although ISO 9001 and maturity model usage in small settings is the subject of a debate which has already been initiated, life cycles need to be addressed.

Section 2. Recent history leading to an ISO/IEC SC7 Project Proposal for small settings

In this section, we describe the history behind the creation of a new ISO/IEC SC7 Working Group (WG)

2.1 First meeting of ISO/IEC SC7 in Australia

At the Brisbane meeting of the SC7 (SC7-04) in 2004, Canada raised the issue of small enterprises requiring standards adapted to their size and maturity level. The current software engineering standards target (or are perceived as targeting) large organizations. Australia supported Canada's position in this regard, and the two national bodies took action to investigate possible ways forward. A meeting of interested parties was held with delegates from five national bodies (Australia, Canada, the Czech Republic, South Africa and Thailand) where a consensus was reached on the general objectives:

- To make the current software engineering standards more accessible to VSEs;
- To provide documentation requiring minimal tailoring and adaptation effort;
- To provide harmonized documentation integrating available standards:
 - Process standards
 - Work product and deliverables

⁵ Capability Maturity Model, CMM and CMMI are registered in the U.S. Patent and Trademark Office. CMM Integration is a service mark of Carnegie Mellon University.

- Assessment and quality
- Modelling and tools
- To generate multiple profiles from the standards mentioned above;
 - A profile is a set of one or more base standards or ISPs, or both, and, where applicable, the identification of chosen classes, conforming subsets, options and parameters of those base standards, or the ISPs necessary to accomplish a particular function. (ISO 10000-1)
- To align, if desirable, profiles with the notions of maturity levels presented in ISO/IEC 15504.

It was also decided that a special interest group (SIG) be created to explore these objectives, to better articulate the priorities and the project plan. The participants felt that it would be possible, during 2004, to achieve:

- A set of requirements;
- An outline of key deliverables, and the associated processes to create them (e.g. how to create profiles);
- A Terms of Reference document for the working group;
- An example of a simple profile.

2.2 First Special Working Group meeting in Thailand

In March 2005, the Thailand Industrial Standards Institute (TASI) invited a Special Working Group (SWG) to advance the work items defined at the Brisbane meeting. The meeting was attended by delegates from the following countries: Australia, Belgium, Canada, Czechoslovakia, Finland, South Africa, South Korea, USA and Thailand.

A key topic of discussion was to clearly define the size of VSE that would be targeted by the working group. The working group used a paper published by the Centre for Software Process Technologies (McFall 2003) to help define the size of small organizations. McFall presents the various perceived priorities and concern areas for different organization sizes. As illustrated in Figure 4, the priorities and concerns for organizations with fewer than 20 employees are different from those of larger organizations. A consensus was reached for IT services, organizations and projects with between 1 and 25 employees.

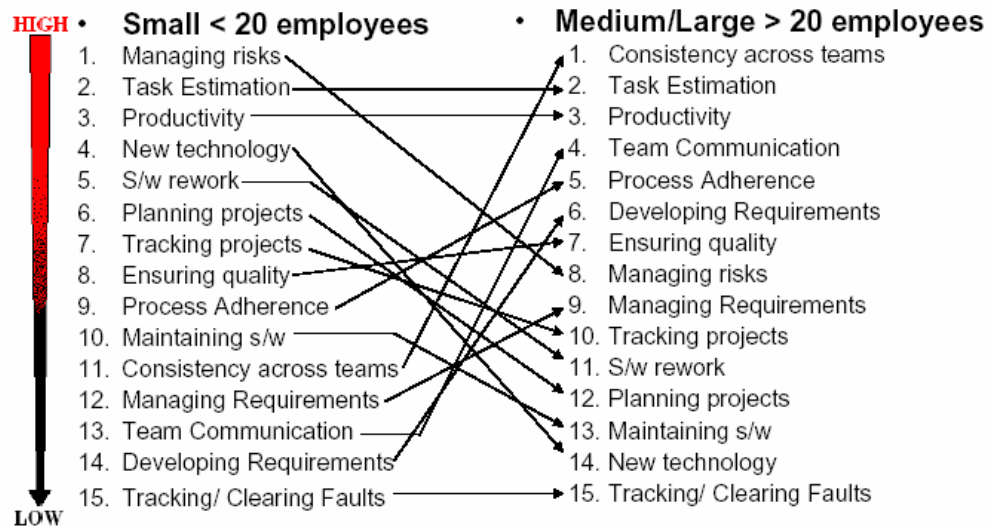


Figure 4. Priorities and concern differences based on organization size (McFall 2003)

A list of actions that could be undertaken by a future ISO/IEC SC7 Working Group was developed at this meeting. The proposed action items are:

1. To validate the Work Products produced by the working group
2. To prepare, conduct, analyze and communicate survey results
3. To search for other centers/organizations focused on SMEs and VSEs
4. To assemble a complete list of characteristics of VSEs and projects
5. To prepare communication material to inform VSEs about the work performed by the WG
6. To develop business cases for the adoption/deployment of work products developed by the WG
7. To develop ISO 12207 Roadmap(s)
8. To pilot Roadmaps

A schedule was also developed for the new working group. As illustrated in Figure 5, the top row shows the standard steps for the development and approval of an ISO standard. There are typically six stages that lead to the publication of a standard (Coallier 2003). After a study period, a new work item (NWI) is developed and sent for balloting. If the ballot is successful, a new project is established with the support of experts from different countries. Then a working draft (WD) is prepared, followed by a committee draft (CD), and lastly a final committee draft (FCD) which is sent for approval.

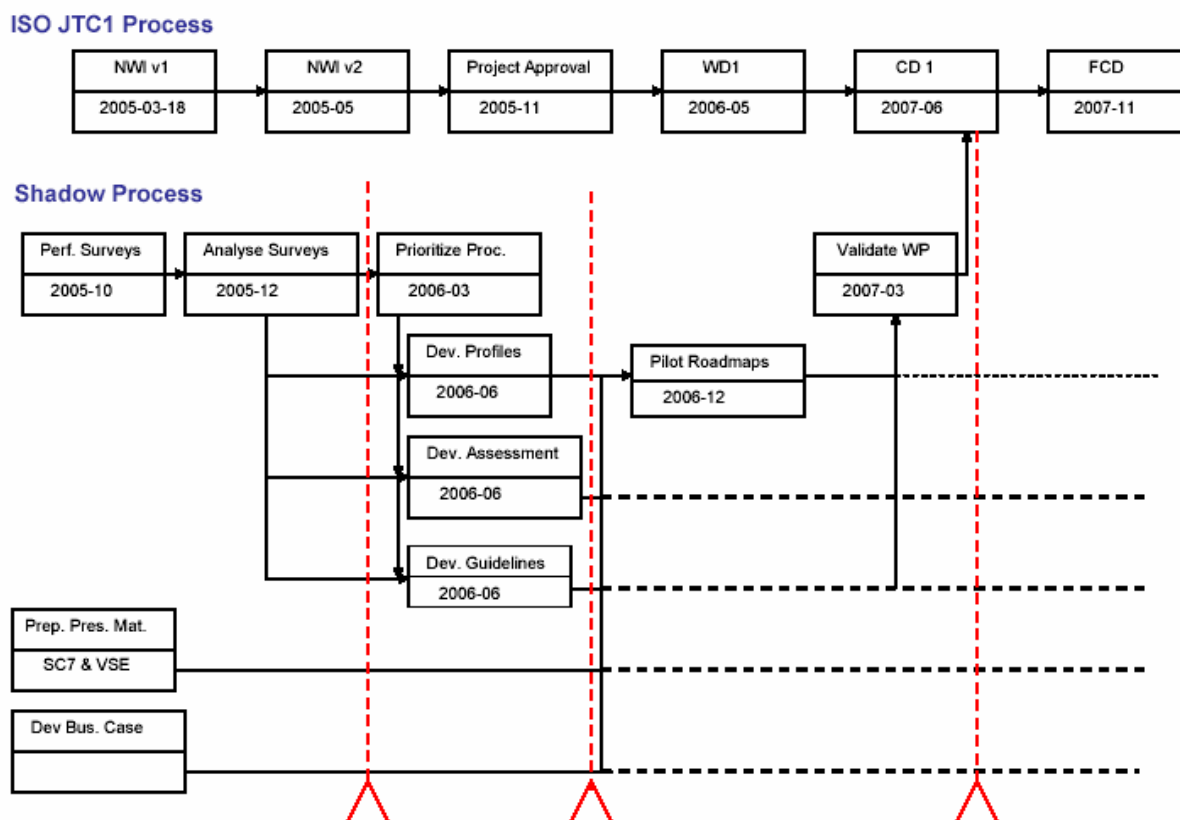


Figure 5. The new working group's proposed work schedule.

The major output of this one-week meeting was a draft of the New Work Item described in section 3.

2.3 SC7 Meeting in Finland

The document developed in Thailand was reviewed during a meeting of one of the WGs at the 2005 SC7 meeting in Helsinki. A resolution was approved as follows: *JTC1/SC7 instructs its Secretariat to distribute for letter*

ballot an updated version of New Work Item Proposal (ISO-05B) for the development of Software Life Cycle Profiles and Guidelines for use in Very Small Enterprises (VSE) by 20 June 2005.

- This document was balloted until 21 September 2005. Over twelve countries voted in favour of the NWI Proposal and the following countries indicated a commitment to participate to the new working group: Belgium, Canada, Czech Republic, Ireland, Italy, Japan, Korea, Luxemburg, South Africa, Thailand, UK, USA.

As a result of this balloting, the Project was approved and the new working group, WG 24, was established as follows:

- Mr. Tanin Uthayanaka (Thailand) was appointed Convener.
- Mr. Claude Y. Laporte (IEEE CS) was appointed Project Editor.
- Mr. Jean Bérubé (Canada) was appointed Secretary.

Section 3. Proposed project tabled at ISO/IEC SC7

The document tabled at the ISO/IEC SC7 Helsinki plenary describes the scope, purpose and justification, and vision statement of a proposed working group. In the following paragraphs, each element of that project is presented. The text below has been extracted from the document balloted by the ISO.⁶

3.1 Project scope

- Organizations and projects with fewer than 25 employees.
- The current scope of ISO/IEC 12207 and its amendments, the associated guidance document and other relevant SC7 Standards (e.g. ISO/IEC 15504, ISO/IEC 90003).
- Production of technical reports (Guides) establishing a common framework for describing assessable life cycle profiles used in VSEs, including small software systems development departments and projects within larger organizations.
 - Guides to be based on International Standardized Profiles (ISP) identifying which parts of the existing standards are applicable to VSEs, at a specific level and for a specific domain.
 - Guides which can be applied throughout the life cycle for managing and performing software development activities, the ultimate goal being to improve the competitiveness and competence of VSEs.

3.2 Purpose and justification

The software systems industry as a whole recognizes the value of VSEs in terms of their contribution of valuable products and services. The majority of software organizations fall within the VSE size category. From the various surveys conducted by some of the national bodies that initially contributed to the development of this NWI, it is clear that the current SC7 Life Cycle Standards (ISO/IEC 12207 and ISO/IEC 15288 and their associated Guides) are a challenge to use in these organizations, compliance with them being difficult (if not impossible) to achieve. Consequently, VSEs have few, or very limited, ways to be recognized as organizations that produce quality software systems, and therefore they do not have access to some markets. Currently, conformity with software engineering standards requires a critical mass in terms of number of employees, cost and effort which VSEs cannot provide.

This project will attempt to ease the use of ISO/IEC 12207 processes and ISO9001:2000, and reduce the conformance obligations by providing VSE profiles. The project will develop guidance for each process profile and provide a road map for compliance with ISO/IEC 12207 and ISO 9001:2000.

⁶ The complete text is available free on the SC7 Web site at: <http://www.jtc1-sc7.org/> as item number N3288.

It has been reported that VSEs find it difficult to relate ISO/IEC 12207 to their business needs and to justify the application of the international standards in their operations. Most VSEs cannot afford the resources for, or see a net benefit in, establishing software processes as defined by current standards (e.g. ISO/IEC 12207/15288) and maturity models. The proposed work will liaise with other work in SC7; specifically, it will track the progress of the ISO/IEC 12207 and ISO/IEC 15288 harmonization projects.

3.3 Vision Statement

This project will:

- Provide VSEs with a way to be recognized as producing quality software systems without the initial expense of implementing and maintaining use of an entire suite of systems and software engineering standards or performing comprehensive assessments.
- Produce Guides which are easy to understand, affordable and usable by VSEs.
- Produce a set of Profiles which builds on or improves a VSE's existing processes or provides a guide to establishing those processes.
- Address the market needs of VSEs by allowing domain-specific profiles and levels.
- Provide examples in order to encourage VSEs to adopt and follow processes that lead to quality software, matching the needs, issues and risks of their domain.
- Provide a baseline for how multiple VSEs can work together or be assessed as a project team on projects that may be more complex than can be performed by any one VSE.
- Develop scalable Profiles and Guides so that compliance with ISO/IEC 12207 and/or ISO 9001:2000 and assessment becomes possible with a minimum of redesign of the VSE's processes.

3.4 Referenced documents

As illustrated in Figure 6, the following documents have been identified as pertinent to this project: ISO 90003, ISO/IEC 12207, ISO/IEC 15288, ISO/IEC 15504, Capability Maturity Model Integration (CMMI) and Software Capability Maturity Model (SW-CMM).

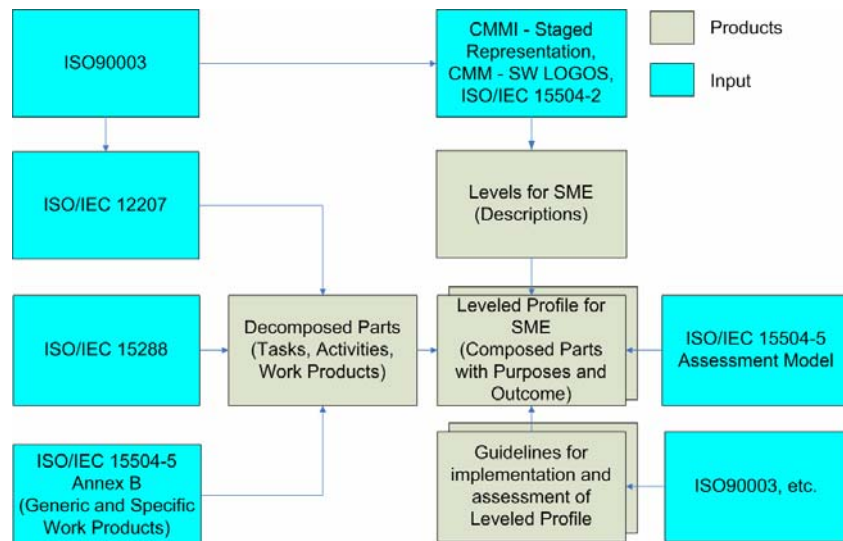


Figure 6. Referenced documents

4. Second Special Working Group meeting in Thailand.

In July 2005, the Thailand Industrial Standards Institute (TASI) sent out a second invitation to participate in the Special Working Group (SWG), to be held in September 2005 in Bangkok. The main objective of the meeting

was to prepare material that would be presented to WG 24 in order to facilitate the start-up of the working group. The main outputs of the meeting were:

- Proposed requirements for International Standard Profiles (ISPs) based on Technical Report ISO/IEC TR10000-1;
- A proposed survey on VSEs' exposure and needs for software development life cycles;
- Proposed approaches to profile development and profile architecture;
 - Proposed business models;
- Proposed agenda for the first WG 24 meeting;
- Proposed draft strategic plan for WG 24;
- Proposed goals of the standard.

Acknowledgments

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Additional Information

The SC7 Web site www.jtc1-sc7.org provides more information. All JTC 1/SC7 standards can be purchased directly from the ISO (www.iso.ch) or from the national standards bodies.

REFERENCES

Anacleto, A., von Wangenheim, C.G., Salviano, C.F., Savi, R. "Experiences gained from applying ISO/IEC 15504 to small software companies in Brazil," 4th International SPICE Conference on Process Assessment and Improvement, Lisbon, Portugal, pp. 33-37 (April 2004).

(CITA) Cellule Interfacultaire de Technology Assessment, "Utilisation des Systèmes d'Information Inter-Organisationnels [SIO] par les PME Belges." SIO *Research Report*, Cita-Computer Sciences Dept., University of Namur, November 1997. *In French*.

Coallier, F., *International Standardization in Software and Systems Engineering*, Crosstalk, February 2003, pp.21.

ISO/IEC TR 10000-1, Information technology – Framework and taxonomy of International Standardized Profiles – Part 1: General principles and documentation framework, Fourth Edition, 1998.

ISO-05A, *New Work Item Proposal – Software Life Cycles for Very Small Enterprises*, ISO/IEC JTC1/SC7 N3288, May 2005. <http://www.jtc1-sc7.org/>.

ISO-05B, *Resolutions – JTC1/SC7 Plenary Meeting*, ISO/IEC JTC1/SC7 N3274, Helsinki, Finland, May 2005.

Laporte, C.Y., Renault, A., Desharnais, J. M., Habra, N., Abou El Fattah, M., Bamba, J. C., *Initiating Software Process Improvement in Small Enterprises: Experiment with Micro-Evaluation Framework*, SWDC-REK, International Conference on Software Development, University of Iceland, Reykjavik, Iceland May 27 - June 1, 2005, pp.153-163.

McFall, D., Wilkie, F.G., McCaffery, F., Lester, N.G., Sterritt, R. Software processes and process improvement in Northern Ireland. *16th International Conference on Software & Systems Engineering and their Applications*, Paris, France, December 2003, 1–10, ISSN: 1637-5033.

SC7-04, Ad Hoc Report – Software Engineering Standards for Small and Medium Enterprises, ISO/IEC JTC1/SC7 /N3060, May 2004. <http://www.jtc1-sc7.org/>

SC7 Secretariat Presentation, ISO/IEC Advisory Group Planning Meeting, Helsinki, May 23, 2005.