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Software engineering — Product evaluation —

Part 2: Planning and management

Ingénierie du logiciel — Évaluation du produit —

Partie 2: Planification et gestion

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Foreword

ISO (the International Organization for Standardization) and IEC (The International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 14598-2 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology,* Subcommittee SC 7, *Software engineering.*

ISO/IEC 14598 consists of the following parts, under the general title *Software engineering — Product evaluation*:

— *Part 1: General overview*
— *Part 2: Planning and management*
— *Part 3: Process for developers*
— *Part 4: Process for acquirers*
— *Part 5: Process for evaluators*
— *Part 6: Documentation of evaluation modules*

Annex A forms a normative part of this part of ISO/IEC 14598.

Introduction

This part of ISO/IEC 14598 provides details about the planning and management requirements which are associated with software product evaluation.

While this part of ISO/IEC 14598 is mainly concerned with product evaluation, wherever it is relevant the corresponding process evaluation activities are also discussed.

This part of ISO/IEC 14598 aims to clarify the requirements which should be provided by the organisation in order to ensure the success of the evaluation. This supporting function can be part of the organisation (e.g. a Technical Group), or a specially created management function.

Software engineering — Product evaluation —

Part 2:
Planning and management

1 Scope

This part of ISO/IEC 14598 provides requirements, recommendations and guidelines for a supporting function which is responsible for the management of software product evaluation and for technologies necessary for software product evaluation.

The role of the supporting function includes motivating people and training them for the evaluation activities, preparing appropriate evaluation documents and methods, and responding to queries on evaluation technologies.

Main targets for evaluation support are software development, system integration and maintenance, including software acquisition, at both project and organisation levels.

Technology management is related to the planning and management of a software evaluation process, metrics and tools. This includes the management of development, acquisition, standardisation, control, transfer and feedback of evaluation technology experiences within the organisation.

The intended users of this part of ISO/IEC 14598 are people who are responsible for

- managing the use of the evaluation technology,
- supporting software product evaluation,
- managing software development organisations,

or people in a quality assurance function. However, it is also applicable to managers involved in other software related activities.

2 Conformance

In order to conform to this part of ISO/IEC 14598, an organisation shall review all requirements and recommendations in clause 6, to identify those which are applicable, and state which requirements and recommendations have not been implemented.

3 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 14598. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO/IEC 14598 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative documents referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 8402:1994, *Quality management and quality assurance — Vocabulary.*

ISO/IEC 9126:1991, *Information technology — Software product evaluation — Quality characteristics and guidelines for their use.*

ISO/IEC 9126-1, *Information technology — Software product quality — Part 1: Quality model.*

ISO/IEC 9126-2, *Information technology — Software product quality — Part 2: External metrics.*

ISO/IEC 9126-3, *Information technology — Software product quality — Part 3: Internal metrics.*

ISO/IEC 14598-1:1999, *Information technology — Software product evaluation — Part 1: General overview.*

ISO/IEC 14598-5:1998, *Information technology — Software product evaluation — Part 5: Process for evaluators.*

ISO/IEC 14598-6, *Software engineering — Product evaluation — Part 6: Documentation of evaluation modules.*

4 Terms and definitions

For the purposes of this part of ISO/IEC 14598, the terms and definitions given in ISO 8402 and ISO/IEC 14598-1 and the following apply.

4.1
evaluation technology (technology used for evaluation)
techniques, tools, metrics, measures and other technical information, used for evaluation

4.2
supporting function
an organisation responsible for assisting the software evaluation activities through the provision of technology, tools, experiences, and management skills

4.3
techniques
methods and skills required to carry out a specific task

5 Evaluation management concepts

This part of ISO/IEC 14598 is applicable to the supporting function, which provides the organisation-wide support to all projects in software development, software acquisition and third party evaluation organisations (see tables 1 and 2).

Table 1 — Software evaluation activities

DEVELOPED SOFTWARE		ACQUIRED SOFTWARE	
Development Activities	Evaluation Activities	Acquisition Activities	Evaluation Activities
The "deliverables" are dependent upon the chosen life cycle e.g. System Requirements Specification, Systems Design Specification	Evaluation of specific "deliverables" (output of the project) e.g. Review System Design	Dependent upon the selected acquisition process e.g. Request for proposal; Suppliers process	Review specific output of the acquisition process Review proposal request Audit supplier's process

The main role of the supporting function should include

- acquisition of relevant international and national standards, technical information and, if required, expert support,
- development of suitable in-house standards and tools based upon the project's and organisation's requirements,
- development of criteria for setting benchmarks for the evaluation,
- reviewing the effectiveness and quality of any software acquisition and development,
- collection and analysis of evaluation results and the dissemination of these within the organisation by the use of a database,
- facilitation of technology transfer, based upon the experiences within the organisation and its respective evaluation projects,
- support of evaluation projects and their respective project managers.

The supporting function can be external or internal with respect to the organisation which is evaluating the software.

If the supporting function is an internal part of the evaluating organisation, it can be within or outside the department which is involved in the software evaluation. The specific roles of the supporting function and the evaluation projects are shown in table 2. This table also shows the relationship between the activities of the supporting function and the evaluation projects.

Table 2 — Relationship between supporting function and evaluation projects

SUPPORTING FUNCTION PROVIDES	EVALUATION PROJECTS DEVELOP
* NEW TECHNOLOGY * INTERNATIONAL/NATIONAL STANDARDS * EXPERTISE (CONSULTANCY) * TRAINING * ORGANISATION DATA BASE * SUPPORT TO EVALUATION PROJECTS	* PROJECT EXPERIENCE * EVALUATION EXPERIENCE * PROJECT DATA * EXPERIENCE WITH TECHNOLOGY * FEED-BACK TO THE SUPPORTING FUNCTION

6 Requirements and recommendations for supporting software evaluation

6.1 General

The organisation shall develop a policy and plans for all evaluation activities. The responsibility of the supporting function shall also be defined for all evaluation activities.

a) The following steps shall be followed when planning and executing software evaluation.

1) Define the objectives of the software evaluation.

2) Ensure that a Quantitative Evaluation Plan for all evaluation projects is developed. This plan may be subdivided into lower level plans, subject to the complexity of the respective evaluation (see Annex A).

3) Enter project and/or product evaluation experiences into the organisation's database, to improve the organisation's approach to software evaluation.

b) Organisations should carry out all their software evaluations in accordance with the following:

1) evaluate whether the software conforms to international, national or internal standards (if that is applicable),

2) ensure that the evaluation results can be quantified, clearly presented and traceable,

3) ensure that suitable and effective technology and best practices are used,

4) ensure that the evaluation is carried out effectively,

5) ensure that plans and recommendations supporting all future evaluation activities are available.

6.2 Management at organisational level

Organisations that develop, acquire or evaluate software repeatedly shall have the overall evaluation responsibilities and quality assurance activities clearly defined and incorporated into a plan.

NOTE - When implemented, this plan will help to improve the quality of the evaluation and ensure the best use of the available and relevant technology.

Some organisations may choose to entrust the evaluation activities to a third party. This third party shall also manage the evaluation technology in accordance with the following requirements and recommendations.

6.2.1 Planning the use and improvement of the evaluation technology

An overall plan for improving the software evaluation and its supporting techniques shall be made and implemented.

The plan should include the following:

a) Preparation of a policy statement

There shall be a policy stating the organisation's approach to the introduction, maintenance and improvement of software quality evaluation.

b) Definition of the organisation's objectives

The organisation's objectives, which are to be achieved by the introduction, maintenance and improvement of software quality evaluation technology, shall be defined.

c) Identification of the technology to be used

The software evaluation methods and techniques used in the organisation shall be assessed and identified in the plan. Any deviation from the stated objectives shall be corrected.

d) Assignment of responsibilities for the management of the evaluation process

Clearly stated responsibility shall be assigned for the introduction, maintenance and ongoing improvement of the evaluation process.

e) Identification of further improvements

The process and activities for investigating the availability and applicability of new technology shall be identified. This includes conducting trials and evaluations, and introducing and maintaining new techniques.

6.2.2 Implementation of the evaluation technology

The organisation shall

a) assess its own and externally available quality evaluation technology and shall determine its technology needs and, if necessary, how any new technology can be acquired,

b) clarify and define the detailed requirements for acquiring or developing the evaluation technology according to the results of the work described in a) above. These plans shall then be implemented,

c) define the process for adopting and operating the acquired evaluation technology.

Any validated evaluation module should be maintained under configuration control, and documented as an Evaluation Module (see ISO/IEC 14598-6). Otherwise it should be put into trial use for assessment.

The software evaluation process for an organisation shall be determined. If this is not available in-house, it shall be acquired.

In the case of acquisition

a) first, if international or national standards are available, the organisation should introduce these,

b) second, if well-known evaluation technology within academia or industry is available, the organisation should consider introducing these,

c) finally, the organisation should consider developing the appropriate technology or contracting an external expert agency to fulfil these requirements.

6.2.3 Transfer of technology used for evaluation

In order to transfer the developed or acquired technology within an organisation, the organisation should prepare training programmes, tools and the appropriate environment for the introduction and adoption of new technology. These programmes, tools and environment need not be uniform, but should correspond to the technology level of the project.

a) Preparation for technology transfer

The organisation should consider the following for the purpose of technology transfer:

1) prepare a Quantitative Evaluation Plan (see Annex A) to include targets, activities, schedules, project objectives and responsibilities for the technology transfer activities,

2) prepare supporting training programmes,

3) prepare tools and environment,

4) define how to collect data and assess the technology transfer,

5) define how to collect experiences about technology transfer.

b) Implementation of technology transfer

The organisation should implement the technology transfer and collect the data according to the defined plan.

c) Assessment of technology transfer

The organisation should assess the technology transfer as follows:

1) assess the effects of the introduced technology for all projects,

2) evaluate the extent to which the technology is used within the organisation.

The organisation should, if necessary, modify or prepare a new plan subject to the results of the assessment.

6.2.4 Assessment of the technology used for the evaluation

In order to achieve better results of the evaluation, the technology used shall be assessed.

The evaluation results which were obtained for a given project should be collected and assessed as follows:

a) Collection and maintenance of the information

The information about the technology necessary for the assessment should be collected, (e.g. the effort spent on measurements and evaluations). This information should be verified, selected, modified and maintained for future use by other projects and for the purpose of verifying the usefulness of the new technology.

b) Analysis and assessment of the evaluation results and the technology used

The software evaluation results shall be analysed and assessed. These analyses and assessments should include the validity of

1) the measurements,

2) the evaluation criteria,

3) the metrics,

4) the techniques,

and the effectiveness of the overall software evaluation. These analyses and assessments should be carried out according to the defined Quantitative Evaluation Plan.

c) Standardisation

The use of the evaluation technology should be standardised within the organisation, wherever this is feasible.

6.2.5 Management of experiences

The manager(s) shall be responsible for the effective use of the evaluation technology in the organisation, and shall ensure that the assessment results and experiences are retained within the organisation. These shall be used to improve the quality and the use of the evaluation technology.

The improvements can be achieved through the modification of the organisation's own evaluation standards which can include items such as the definition of quality requirements, metrics selection, definition of rating level and assessment criteria.

The following approach is recommended:

a) Carry out periodic quality evaluation reviews,

b) Integrate existing standards with new evaluation standards and with the use of new metrics,

c) Provide feedback of evaluation results to these standards,

d) Provide feedback of the evaluation results to the organisation's Quality Plan and/or Quality Manual,

e) Maintain records of the improvements and ensure the utilisation of "best practices" within the organisation.

6.3 Support for Project Management

The project management of specific evaluation projects is assisted by the supporting function. This function can have overall responsibility for all evaluation activities and technology used within the organisation.

This includes evaluation planning, the promotion of this plan and the technology transfer between the project and the organisation.

For the management of an evaluation project (see clause 5) there shall be an agreed Quantitative Evaluation Plan.

The evaluation should be managed by an experienced project manager; and have

- an approved budget,
- suitable human and machine resources,
- supporting tools, standards and procedures,
- a clearly defined, documented and agreed Quantitative Evaluation Plan.
  This plan should specify how the stated objectives will be achieved, and also how and when these measurements are to be used in support of the evaluation process.

The functional support manager responsible for the overall evaluation strategy and technology within an organisation should support the project manager in the implementation of this plan.

6.3.1 Support for Evaluation Planning

In order to carry out software product evaluation successfully, a Quantitative Evaluation Plan should be developed at the start of a project or evaluation. The aim of the plan is to assist the project manager in defining and monitoring quantitative quality objectives. It should also assist all project staff in identifying their own quality objectives and in monitoring their progress continuously against those objectives.

The following should be considered when such a plan is prepared.

a) The purpose and use of the plan

All project members should understand the importance of the proposed plan, its implementation details and its relevance to each individual project member. All this should be clarified prior to any evaluation activity.

The usefulness of this plan should be acknowledged and supported by all project personnel as well as by the management not directly involved with the project or the evaluation process.

b) Improvements to the plan

The draft plan should be checked and improved by the manager responsible for the overall evaluation within an organisation. It should be reviewed in order to ensure that it adequately covers the various evaluation requirements, which include the following:

1) specification of how the stated objectives will be achieved, and also how these will be quantified and measured. It will also state how these measurements will support the evaluation process,

2) specification of how quantitative management is to be carried out during software product evaluation,

3) respective quality objectives,
NOTE - These may be product, process or even size related

4) clarification of the tasks, and assignment of corresponding responsibilities,
(e.g. who is responsible for data collection, analysis and feedback to the project staff and to the management)

5) definition of how data is to be collected, controlled and used.

c) Content of the plan

The content of this plan should cover all measures applicable to the characteristics of the software product.

The objectives stated in the plan should be supported by the corresponding product quality characteristics, and also by the choice of process quality criteria, the adopted standards, methods, staff skills, tool support and project management.

A template is shown in Annex A.

d) Detailed planning support

In order to support the planning of an evaluation project all useful specific information should be transferred to the project. This includes the planned template and the related evaluation technology, which contains details about

1) similar project planning experiences,

2) the use of the same technology,

3) the organisation's standards and quality model,

4) the use of recommended optional and mandatory metrics,

5) measurement know-how, such as data element; measurement methods; tools; measurement frequency; and condition,

6) setting the specific rating level.

6.3.2 Ongoing promotion of the Quantitative Evaluation Plan

In order to gain the confidence of the project members about the usefulness of the plan and to encourage them to actively participate in its implementation, the following activities should be carried out if appropriate.

a) set up a meeting for explaining the technical aspects of the plan

b) set up lectures on software quality evaluation

6.3.3 Supporting the evaluation projects

The supporting function should monitor the implementation status of the evaluation project at scheduled intervals.

If some issues are identified, the necessary support should be provided in order to resolve and record these issues for the purpose of building up experiences for future use.

6.3.4 Collection of the evaluation results

The supporting function should collect the evaluation results at the end of each evaluation project. These should be stored for reference purposes and can be used by future projects.

Annex A
(normative)

Quantitative Evaluation Plan Template

A Quantitative Evaluation Plan should include the following chapters. If any chapter is not applicable it should be so indicated.

A.1 Chapter 1 Introduction

The following should be described:
- the purpose of the plan
- the audience of the plan
- the intended use of the plan

A.2 Chapter 2 Evaluation objectives

This chapter should provide a clear statement about the objective(s) of the evaluation and the intended application of the software. This can be stated in terms of business needs. However, they should be useable for the purpose of setting quality objectives and respective criteria, (e.g. the application of safety critical systems to be used for automated landing of aircraft where these requirements are to be specifically stated).

A.3 Chapter 3 Applicable quality characteristics

This chapter should provide statements of the quality characteristics (e.g. ISO/IEC 9126 series) which support the objectives prescribed in A. 2

The stated quality objectives may be both product and process oriented, (e.g. reliability or maintainability as product quality characteristics; all testers have proven test harnesses and were trained in the use of test tools as process quality targets).

A.4 Chapter 4 List of priorities

This chapter should prioritize the above characteristics and should provide a supporting rationale for these priorities.

NOTE - Priorities may cover process requirements, (e.g. from the point of view of the business, training of staff may be deemed a higher priority than the introduction of a new method or tool).

A.5 Chapter 5 Quality objectives (characteristics)

This chapter should provide quantifiable quality objectives which are measurable at interim or final phases of the project development, (e.g. number of errors per lines of code during final testing, or number of faults per total entry which is under the control of the latest version of the configuration management system). It may state the maximum down-time of an installed product or system. This is further explained in ISO/IEC 9126 parts 1 and 2.

A.6 Chapter 6 Schedules

This chapter should provide a clear plan of objectives with milestones and stated deliverables.

A.7 Chapter 7 Definition of responsibilities

This chapter should define all envisaged responsibilities associated with the implementation of the Plan. This includes all data collection, analysis tasks, implementation of other supporting requirements, reporting, follow up and similar requirements.

A.8 Chapter 8 Measurement categories

This chapter should define the various measurements which are planned to be carried out. If both product and process measurements are taken these should be categorised and carried out as follows:

a) Product quality measurements

Include measurements such as performance, reliability and portability. State at what stage of the development these measurements are to be carried out, how often they are repeated, what techniques or tools are used to aid data capture and analysis, and what actions are envisaged if there are divergences from the stated objectives.

These measurements can be final or intermediate and they can be obtained through the use of sub-characteristics.

b) Process quality measurements

Describe how process measurements are to be carried out. Include the monitoring of the effectiveness of standards, tools usage, project management, etc. (Refer to ISO 9000 series)

These measurements can also be carried out at various phases of the project life cycle. Define and document how process related corrective actions are to be carried out if corrective action is deemed necessary.

A.9 Chapter 9 Using and analysing data

This chapter should define how data is to be analysed, what, if any, statistical methods are to be employed and what presentation techniques are to be used.

It should make references to previously stated responsibilities, supporting tools and forms. It should also state how the information is envisaged to be integrated into the progress tracking process or into the product acceptance process.

A.10 Chapter 10 Reporting

This chapter should define whether the analysed results are to be reported within or outside the project or product evaluation and should also define how to resolve all outstanding items.

A.11 Chapter 11 Other requirements

This chapter (or a number of chapters) can be used to include requirements not covered previously, e.g. it can include the following information.

a) Techniques and methods employed

Provide a full description (or provide references to other material) of the techniques and methods used, (e.g. method for sizing; development maturity assessment; inspection method for error detection; defect removal model for predicting error rates).

The section or the referred material should be clear and complete so that it can be easily understood and used by all nominated personnel.

b) Supporting tools

Describe or provide references - as in item a) above - but covering the tool support requirements. This can include guides for the use of databases, spreadsheet and statistical packages.

c) Relevant standards and guides

Refer to applicable standards and supporting guides. Describe their use and benefits relevant to the purchasing and acquisition processes (e.g. ISO/IEC 9126; ISO 9001; ISO 9000-3).

d) Suppliers' evaluation

Include evaluation and measurement procedures for the effective quantitative assessment of the software product suppliers.

This can cover the number of released copies, current error status, surveys about post installation support performance, statistics about past and current users satisfaction, management performance and financial stability. Related parameters relevant to the application, which have been obtained from other suppliers, can be incorporated in the suppliers' evaluation plan.

Bibliography

For process evaluation details the following are also relevant.

ISO 9001:1994, *Quality systems — Model for quality assurance in design, development, production, installation and servicing.*

ISO 9000-3:1997, *Quality management and quality assurance standards — Part 3: Guidelines for the application of ISO 9001:1994 to the development, supply, installation and maintenance of computer software.*

ISO 9004-5, *Quality management and quality system elements — Part 5: Guidelines to quality plans.*

ISO 9004-7, *Quality management and quality system elements — Part 7: Configuration management.*

ISO/IEC 12207:1995, *Information technology — Software life cycle processes.*

ISO/IEC 15504 (all parts), *Information technology — Software process assessment.*

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