TECHNICAL REPORT

ISO/IEC TR 33015

First edition
2019-08

Information technology — Process assessment — Guidance for process risk determination

Technologies de l'information — Évaluation des processus — Recommandations pour la détermination des risques liés aux processus

Reference number
ISO/IEC TR 33015:2019(E)

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Published in Switzerland

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Joint Technical Committee ISO/IEC/TC JTC1, *Information technology*, Subcommittee SC 7, *System and software engineering*.

This first edition cancels and replaces ISO/IEC TR 15504-4:2004 and ISO/IEC TR 15504-9:2011, which have been technically revised.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is part of a set of International Standards ISO/IEC 33001 – ISO/IEC 33099, termed the ISO/IEC 330xx family, designed to provide a consistent and coherent framework for the assessment of process quality characteristics, based on objective evidence resulting from implementation of the processes. The framework for assessment covers processes employed in the development, maintenance, and use of systems across the information technology domain and those employed in the design, transition, delivery, and improvement of services. Results of assessment can be applied for improving process performance, or for identifying and addressing risks associated with application of processes.

This document provides guidance on the application of the results of process assessment for process risk determination. The guidance covers:

— Initiating process risk determination

— Identifying relevant processes and the relevant process context

— Defining target process profile

— Defining target assessment input

— Assessing current process quality

— Determining proposed process quality characteristic achievement

— Verifying proposed process quality characteristic achievement

— Analysing process-related risk

— Acting on results

This document is primarily addressed to the stakeholders of the process risk determination, members of the process risk determination team and other people, such as lead assessors or assessment team members, who need guidance on performing a process risk determination based on conformant process assessments. It will also be of value to developers of process assessment methods and tools supporting process assessment as well as members of assessed organizations.

The set of International Standards ISO/IEC 33001 – ISO/IEC 33099 defines the requirements and resources needed for process assessment. The overall architecture and content is described in ISO/IEC 33001.

This document assumes familiarity with the normative parts of the ISO/IEC 330xx family of standards.

Several International Standards in the ISO/IEC 330xx family of standards for process assessment are intended to replace and extend parts of the ISO/IEC 15504 series. ISO/IEC 33001:2015, Annex A provides a detailed record of the relationship between the ISO/IEC 330xx family and the ISO/IEC 15504 series.

Information technology — Process assessment — Guidance for process risk determination

1 Scope

This document provides guidance on the application of the results of a process assessment for process risk determination.

The guidance provided does not presume specific organizational structures, management philosophies, life cycle models or development methods. In relation to process risk determination, this guidance is applicable within any customer–supplier relationship, and to any organization wishing to perform a process risk determination of its processes.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 33001, *Information technology — Process assessment — Concepts and terminology*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 33001 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
process risk determination
systematic assessment and analysis of selected processes against a target process profile, carried out with the aim of identifying process-related risks to meet a particular specified requirement

3.2
process-related risk
risk resulting from weaknesses in the performance, management, or deployment of a process

4 General introduction

4.1 Determining process-related risk

The purpose of process assessment is to understand the state of the processes implemented by an organizational unit.

Results of a process assessment can be applied for improving process performance, or for identifying and addressing process-related risks associated with the application of processes.

Guidance on using process assessment as part of a complete framework and method for process improvement as part of a continual improvement activity is provided in ISO/IEC 33014.

This document focuses on using the results of process assessment to identify process-related risks and to determine the significance associated with application of the processes for a particular requirement or category of requirements. This can be performed to support risk mitigations, or to support decision making in acquisition scenarios.

NOTE 1 The particular requirement or the category of requirements can involve deploying an organization's processes for a new or an existing task, a contract, category of contracts, or an internal undertaking, a product or a service, or any other business requirement. The particular requirement or the category of requirements is defining the objective(s) for the process risk determination.

NOTE 2 Process risk determination does not address all aspects of risk, which can include strategic, organizational, financial, personnel and many other factors. The output from a process risk determination feeds into an organization's risk management process, but only with respect to process-related risk – as outlined in 6.6.

Determining process-related risks from process assessment results is based on mapping weaknesses to risks. Weaknesses are represented by process attribute ratings which differ from a full achievement. By comparing the achievement of process attribute ratings with a target process profile gaps can be identified which may give evidence to one or more specific risks.

The alignment of the underlying scope of the assessment to the particular requirement or category of requirements will impact the significance of the results of the process risk determination. When assessing processes with respect to a given process quality characteristic, ISO/IEC 33002 requires the identification of the process context as a part of the assessment scope. The process context describes the relations and dependencies between the application of a set of processes and their impact on a developed product, service or the organization developing it.

When aligning the assessment scope to the particular requirement or category of requirements, this should be done with respect to

— the impact of the selected processes to identified risks under investigation; and

— the comparability of the process context with the intended application of the processes for a particular requirement or category of requirements.

An assessment may be conducted specifically to determine process-related risks or may be selected from a pool of existing results.

In the first case, a target assessment scope including the process context should be defined as an input to the assessment. 6.3 provides guidance when defining a target assessment input.

In case the results are taken from a pool, special analysis should be performed to assure the significance of a selected assessment result as described in 6.8.

In any case, a target process profile of the desired extent of achievement of the process quality characteristic should be defined in relation to a given process context (for example, in relation to the development of a specific system). As described in 4.3.2, the target process quality level should be set up with respect to the existing particular requirements for the process risk determination thus matching the specific types of risks to be evaluated.

4.2 Process risk determination — purpose and outcomes

The purpose of process risk determination is to identify risks and to determine the significance of identified risks associated with application of the processes for a particular requirement or category of requirements.

As a result of successful implementation of process risk determination:

— objectives of the process risk determination are defined by identifying the particular requirement or category of requirements;

— types of risks to be evaluated appropriate to a particular requirement or category of requirements are identified, if applicable;

— target assessment input including the assessment scope and the process context is identified;

— target process profile in line with the target assessment input and appropriate to the objectives of the process risk determination is specified;

— process quality levels are determined according to the process context and the selected process profile;

— any gaps between target and assessed process quality characteristics are analysed;

— specific process-related types of risks are evaluated based on the gap analysis.

NOTE 1 The selected processes are chosen by the team as described in 5.2.2.

NOTE 2 The determination of process quality levels is generally carried out following a process assessment of the organization's implemented processes, as described in ISO/IEC 33002.

4.3 Significance of the process risk determination results

4.3.1 Impact of the assessment scope and the process context on the results of the process risk determination

When performing an assessment, the lack of achievement of process quality attributes for a selected process reference or process assessment model can give evidence for a specific risk or type of risk. Each risk type requires an appropriate assessment scope to be defined including a determined process context.

If an assessment is conducted specifically to determine process-related risks or if an assessment result is selected from a pool of existing results, the underlying assessment scope including the process context will impact the significance of the results.

To increase the significance of the results and conclusions, the process risk determination team may identify the type of risks to be addressed according to the particular requirement or category of requirements for the process risk determination. According to the identified type of risk, an appropriate target assessment scope should be set up, which is the base for defining the target assessment capability profile. Annex A provides a guideline on categorizing types of process-related risks.

The significance of the process risk determination results is further increased by defining specific assessment guidelines including criteria for collecting data and information collection as described in 6.5.

4.3.2 Categorizing process-related risks

The types of risks to be identified are defined by the objectives of the process risk determination and associated with application of the processes for a particular requirement or category of requirements.

To increase the level of significance of the process risk determination result, a specific type of risk may be identified after initializing the process risk determination to provide input for the sub-sequent steps. When identifying types of process-related risks, the risks may be grouped to categories for a particular requirement. This may be done by mapping identified risk root causes to deficits in the achievement of process quality attributes. Annex A shows an example of a categorization of types of process-related risk.

When focussing on a specific type of risk this has an impact on the definition of the target assessment input, the target process profile and the criteria for data and information collection.

4.3.3 Defining specific rating guidelines

Specific rating guidelines including the criteria for data and information collection may be set up by a community of interest to increase the significance and comparability of process risk determination results.

Refer to 6.5.4 for additional information.

5 Process risk determination process

5.1 Overview

Figure 1 illustrates the steps of process risk determination utilising a process assessment performed according to ISO/IEC 33002.

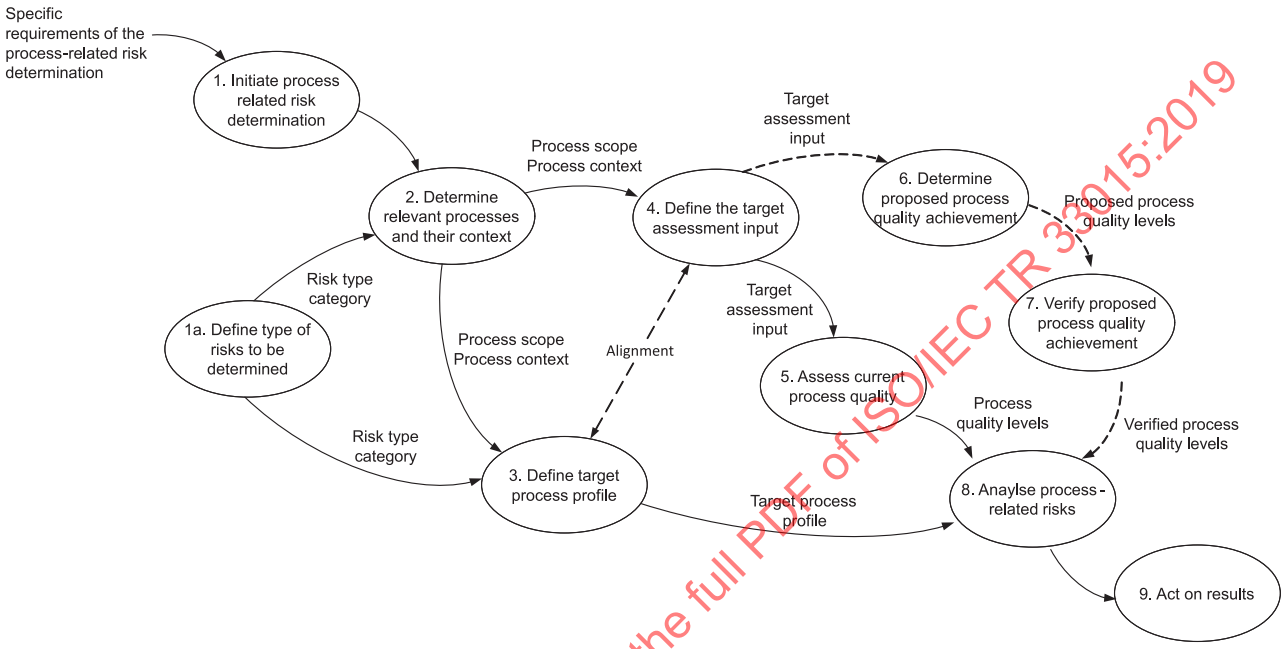

Figure 1 — Steps of process risk determination

The ovals in Figure 1 represent steps in the process, and the arrows represent information being passed between steps.

5.2 Activities of process risk determination

5.2.1 Step 1 – Initiate process risk determination

A process risk determination plan should be produced, approved by the sponsor, and used to monitor progress. The plan should include:

— the purpose of the process risk determination;

— the process assessment method to be used;

— the organizational scope i.e. the organizational unit whose processes are to be the subject of the process risk determination;

— the target process profile (inserted after it has been defined in step 3);

— key roles and responsibilities;

— resources;

— appropriate milestones, review points, and reporting mechanisms.

When carrying out the process risk determination as part of a supplier selection activity, the sponsor may decide either to disclose the target process profile to the potential suppliers, or not, as appropriate.

The sponsor may also invite the organizational unit to submit a statement of the process quality characteristics that it proposes to bring to bear in meeting the specified requirement.

The team may optionally perform a categorization to align the assessment scope to the particular requirement or category of requirements with respect to the impact of the selected processes to identified risks under investigation and the comparability of the process context with the intended application of the processes for a particular requirement or category of requirements.

Please refer to Annex A for additional guidance.

5.2.2 Step 2 – Identify relevant processes and the relevant process context

The team identifies relevant processes and associated process reference and assessment models.

The process context of the intended application of the processes for a particular requirement or category of requirements is identified.

Please refer to 6.3.3 to 6.3.5 for additional guidance.

5.2.3 Step 3 – Define target process profile

The team defines the target process profile, as described in 6.4.

The target process profile comprises a set of target process profiles that express the process quality which the team judges to be adequate, subject to an acceptable process-related risk, for meeting the specified requirement.

5.2.4 Step 4 – Define target assessment input

The target assessment input is prepared as described in 6.3.

A target assessment input is defined, which is either provided as an input for an assessment performed specifically to determine process-related risks or which is considered when selecting from a pool of existing assessment results.

The target assessment input should comprise as a minimum:

— the process quality characteristic and process measurement framework as described in 6.3.2;

— the process reference and assessment model as identified in step 2;

— the identified relevant processes and the relevant process context as defined in step 2 and in line with the target process profile as defined in step 3;

— the criteria for data and information collection as described in 6.5.3.

The target assessment input may also comprise specific rating rules or recommendations as described in 6.5.4.

Please refer to 6.3 for additional guidance.

5.2.5 Step 5 – Assess current process quality

The team may invite the organizational unit to perform an ISO/IEC 33002 conformant self-assessment based on the defined target assessment input and provide the results to the team.

Alternatively, the team may decide to initiate an independent process assessment, bearing in mind the nature, cost and importance of the specified requirement.

In either case, the output from the assessment of current process quality characteristic achievement will take the form of a set of process profiles as defined in ISO/IEC 33002.

Please refer to 6.5 for additional guidance.

5.2.6 Step 6 – Determine proposed process quality characteristic achievement

If invited to do so, the organizational unit may optionally submit to the team a statement of the process quality characteristic achievement that it proposes to bring to bear in meeting the specified requirement. The proposed process quality characteristic achievement should be based on one or more process assessments which:

— satisfy the requirements of ISO/IEC 33002;

— are a true representation of the organizational unit's current process quality characteristics with respect to the given target assessment input;

— may been produced specifically for the process risk determination, or generated during a recent self-assessment, or produced following a recent independent assessment.

A key feature of ISO/IEC 33002 is that process assessment outputs are re-useable. Many organizational units will have a repository of process assessment outputs generated as part of a process improvement programme. If a number of suitable process assessments are available, then the organizational unit may use the outputs as the basis of a proposed process quality characteristic achievement. If not, then the organization may carry out a self-assessment in accordance with the requirements of ISO/IEC 33002.

Please refer to 6.8 for additional guidance.

5.2.7 Step 7 – Verify proposed process quality characteristic achievement

If the organizational unit has submitted a statement of the process profile that it proposes to bring to bear in meeting the specified requirement, then the team should review the proposed process profile to establish how much credibility it merits, and decides what further action is needed to establish confidence in it. This will typically involve:

— checking that the proposed process profile is based on one or more conformant process assessments;

— checking the credibility of any improved process quality characteristic achievement by reviewing it against the defined target assessment input;

— checking the topicality of the assessment result.

NOTE Since detailed information about the underlying assessment (e.g. the list of collected evidence or the assessment plan) can be unavailable to the team, the verification can be supported by self-declaration of the providing organizational unit.

The sponsor may accept the proposed profile or decide to initiate an appropriate degree of independent process assessment. This may involve a sample of selected processes, or a comprehensive independent assessment of all processes specified in the target process profile. Having carried out the verification assessment, the team will be able to compare this output with the organization's proposed process quality characteristic achievement and derive a profile to be used for subsequent risk analysis.

If the process risk determination involves a number of competing suppliers, then the sponsor may wish to verify each supplier's proposed process profile by using an independent assessment team, the same assessment method and the same conformant process assessment model. This should not only provide the sponsor with greater confidence in the consistency with which each supplier is assessed, but also provide the suppliers with greater confidence in the fairness of the selection process.

If several organizational units – i.e. subcontractors, partners in a joint venture, or distinct divisions of an organization - will be involved in meeting a specified requirement, then the proposed process profile will comprise contributions from each of the organizational units.

Please refer to 6.6.2, 6.7 and 6.8 for additional guidance.

5.2.8 Step 8 – Analyse process-related risk

Process-related risk is assessed from the *probability* of a particular problem occurring, and from its potential *consequence*, should it occur as outlined in 6.6.

The chosen process risk determination method should contain a defined approach to analysing risk. A possible approach is outlined in Annex A.

5.2.9 Step 9 – Act on results

If the process risk determination has been carried out to determine the suitability of another organization's processes for a particular contract or category of contracts, then the sponsor will wish to take into account the assessment of process-related risk not only in making contract award decisions, but also when establishing contractual commitments related to ongoing risk management activities.

If the process risk determination has been carried out by an organization to determine the process quality characteristic achievement of its own processes for a particular requirement or category of requirements, then the sponsor may wish to initiate a process improvement programme to address any process-related risk issues identified.

6 Guidance on process risk determination

6.1 General

This clause provides guidance on issues specific to process risk determination.

6.2 Initiating the process risk determination

The process risk determination is based on the results of process assessments.

As described in 4.1 the objectives for the process risk determination are defined by a particular requirement or category of requirements. These requirements are determined and defined by the sponsor in line with the organization's business goals.

ISO/IEC 33002 requires that any process assessment identify the assessment sponsor and possible assessment constraints. The sponsor for process risk determination may be, but is not generally, the same as the assessment sponsor. Especially when the process risk determination is performed in the context of supplier selection, the results might be requested by a customer organization represented by a sponsor from a pool of assessments available at the supplier which have been performed under the responsibility of different assessment sponsors.

The sponsor first decides whether or not to carry out a process risk determination.

The process risk determination should be implemented as a project in its own right, with defined project management, budget, milestones, and accountability. In short, the project should be managed according to a project management process, aligned to the process assessment model being used.

The sponsor should set up a process risk determination team to initialize the process-related risk determination, to determine the target assessment input and the target process profile, and to evaluate the process-related risks.

6.3 Determining the target assessment input

6.3.1 General

ISO/IEC 33002 requires that any process assessment define the assessment input. Since the process risk determination is superimposing the process of performing a process assessment, the team should determine a target assessment input, which is either provided as an input for an assessment performed specifically to determine process-related risks or should be considered when selecting from a pool of existing assessment results.

The ownership of the assessment outputs and any restrictions on their use, plus any controls on information resulting from a confidentiality agreement, are defined within the assessment input, reflecting any confidentiality agreements in place that affect the overall process improvement programme or process risk determination.

6.3.2 Selecting the process quality characteristic and the process measurement framework

A process quality characteristic is a measurable aspect of process quality; typically it comprises a set of process attributes that are significant to process quality. Process quality characteristics may include such characteristics as process capability, process security, process integrity, or process flexibility. In conducting a process risk determination, it is important to identify any process quality characteristic that may be associated with significant risks in the organization context. This may be supported by categorizing different types of risks as described exemplarily in Annex A. Evaluation of the extent of achievement of the selected process quality characteristic should be based upon a process measurement framework meeting the requirements of ISO/IEC 33003.

NOTE At the present time, the only process quality characteristic for which a conformant process measurement framework has been developed is process capability; the process measurement framework is defined in ISO/IEC 33020.

6.3.3 Selecting process reference model(s)

Process risk determination requires the selection of suitable process reference model(s).

A process reference model describes a set of processes in terms of purpose and outcomes as defined in ISO/IEC 33004. A process reference model has a declared domain of use. ISO/IEC/IEEE 12207 and ISO/IEC 15288 are process reference models within the domains of software engineering and systems engineering respectively; a variety of other process reference models are available.

The team should determine which process reference model(s) are best suited to the needs for process risk determination.

6.3.4 Selecting the process assessment model

Based on selected process reference model(s) and the selected process quality characteristic, the relevant process assessment model and process measurement framework will be selected.

Where a choice is to be made between valid process assessment models, a key factor will be the suitability of the indicator set used in the process assessment model for the risk profile to be established.

6.3.5 Selecting the set of processes

To reduce the effort of the process risk determination and associated assessment activities, the selected process assessment model should be tailored to a set of processes which is indispensable for the process risk determination objectives. An exemplary approach is shown in Table 1.

Table 1 — Tailoring the set of processes from the process assessment model

Step	Action	Rationale
Select an initial set of processes	Select the Technical Processes	The Technical Management Processes contribute most directly to the delivery of products
Review the selected processes	Review the selection of processes and exclude any processes not relevant to the specified requirement for the process risk determination	Some processes, like e.g. acquisition processes might not be relevant in terms of the specific requirements of the process risk determination
Add further processes	Add Technical Management Processes and Organizational Project Enabling Processes	The Technical Management Processes and Organizational Project Enabling Processes are critical to establishing high levels of process capability within an organization For example, if the Performance Management attribute (PA2.1) has been included for a Technical Process, then the Project Planning and Project Assessment and Control processes should also be included

NOTE The approach of tailoring processes from a given process assessment scope can be supported by standard scopes defined by the organization or a community of interest.

6.3.6 Determining the process context

As described in 4.3.1 the comparability of the process context with the intended application of the processes for a particular requirement or category of requirements determines the significance of the process risk determination results.

As an example, when the objectives of the process risk determination are to determine process-related risks for the quality of a specific product, it is obvious, that the assessment should be performed on the development process instances for this specific product. In this case the process context considered for the assessment will ideally reflect the application of the given set of processes and their impact on the developed product.

If the process risk determination is applied for supplier selection, a product or service is planned to be developed based on specific requirements of the customer. The process risk determination can provide a prediction, how the supplier's organization may perform in case it is selected by the customer. Since the assessment cannot be performed within the development of the specific product or service requested by the customer because the development has not been started, the team should determine the process context for the target product. This should match the process context considered for the assessment, which serves as a base for the process risk determination.

6.4 Defining target process profile

The sponsor should then specify, for each selected process, a target process profile showing which process attributes are required, and - for each process attribute - what rating is judged necessary. Only process attribute ratings of "Fully achieved" or "Largely achieved" should be set; "Not required" should be noted for any process attributes deemed not necessary. "Partially achieved" should not be set since this would indicate that some aspects of achievement may be unpredictable, as defined in ISO/IEC 33020. Where the extent of achievement of a process attribute is not seen as relevant to the determination of risks related to performance of a specific process, a blank target rating may be included; this does not, however, imply that the attribute should not be rated in the assessment.

The set of target process profiles expresses the target process attribute achievement which the sponsor judges to be adequate, subject to an acceptable process-related risk, for meeting the specified requirement (for process risk determination) or business goals (for process improvement).

Table 2 — Example target process attribute achievement

Selected process from process reference model	Process attributes	Required process attribute rating
TEC.3 System requirements definition	PA 1.1	Fully achieved
	PA 2.1, PA 2.2	Largely achieved
TEC.4 Architecture Definition	PA 1.1, PA 2.1, PA 2.2, PA 3.1, PA 3.2, PA 3.3	Fully achieved
	PA 4.1, PA 4.2	Largely achieved
MAN.5 Configuration management	PA 1.1, PA 2.1, PA 2.2	Fully achieved
	PA 3.1, PA 3.2, PA 3.3	Largely achieved
MAN.1 Project Planning	PA 1.1, PA 2.1, PA 2.2, PA 3.1, PA 3.2, PA 3.3	Fully achieved
MAN.2 Project Assessment and Control	PA 1.1, PA 2.1	Fully achieved
	PA 2.2	Not required
	PA 3.1, PA 3.2, PA 3.3	Largely achieved

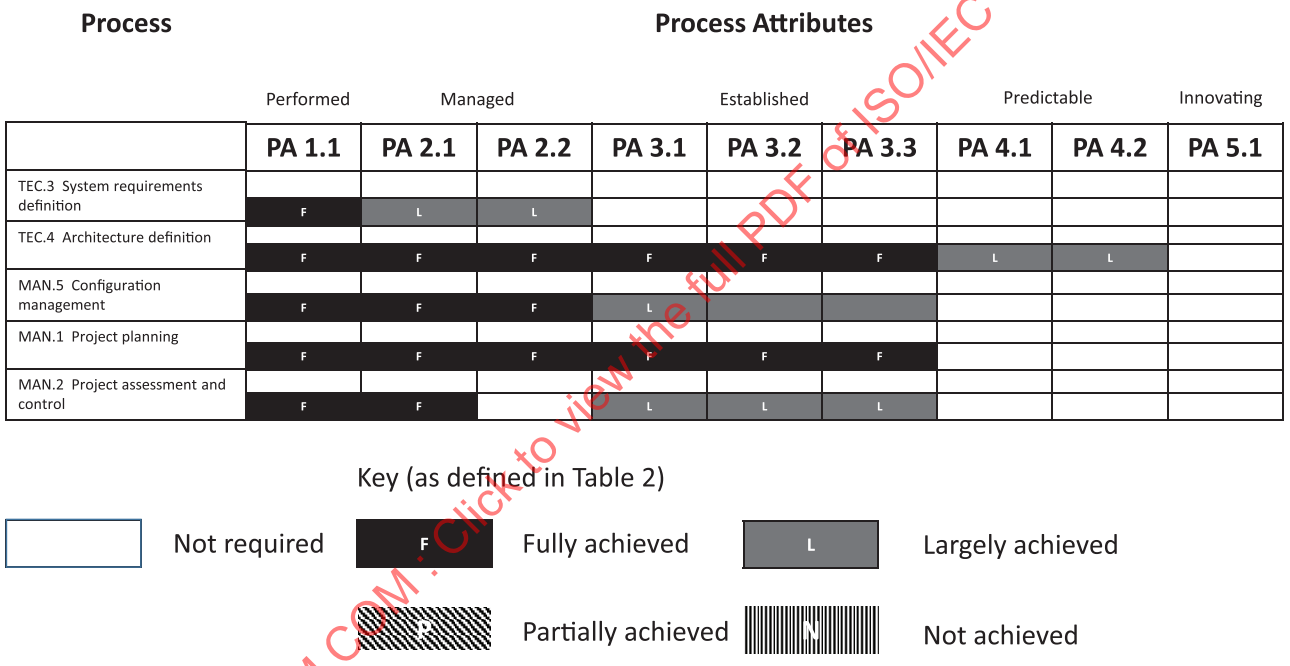

Figure 2 — Example target process attribute achievement presented as set of target process profiles

Table 2 and Figure 2 illustrate an example target process attribute achievement, for the process quality characteristic process capability. The process attributes (PA 1.1 etc) and ratings (Fully achieved etc) are defined in ISO/IEC 33020. Figure 2 illustrates a target process profile for the characteristic process capability, where required ratings have been specified for individual process attributes.

Target process attribute achievement can also be expressed by specifying a required process quality level rating for each selected process. This approach is also illustrated in Figure 2, using the required process attribute ratings shown in ISO/IEC 33020:—, Clause 6. The required process attribute ratings for TEC.3 System Requirements Definition correspond to Capability Level 2, the required ratings for MAN.5 Configuration Management correspond to Capability Level 3, and the required ratings for TEC.4 Architecture Definition correspond to Capability Level 4. For MAN.2 Project Assessment and Control, no rating was seen as required for PA 2.2; this could imply that a required rating of Capability Level 1 is seen as adequate.

A defined process risk determination method should include a means of setting target process attribute achievement from analysis of the specified requirement. This may be supported by mapping identified risk root causes to deficits in the achievement of process quality attributes as described in 4.3.2 and shown exemplarily in Annex A.

One simple approach to establishing target process profile is set out in Table 3.

Table 3 — Setting target process profile

Step	Action	Rationale
Identify the set of processes	Select the set of processes defined in the target assessment input (refer to 6.3.5)	This step ensures the alignment of the target process quality profile to the objectives of the process risk determination
Set default required process attribute ratings for the initial set of processes	Set all process attribute ratings for capability levels 1 - 5 to Fully achieved	This step ensures a full coverage of the selected processes
Tailor PA ratings	Reduce which are not necessary for the identified type of risk	This approach ensures that selected processes are fully performed; that management practices are in place to avoid missed deadlines, budget overspend and product quality problems; and that processes are deployed following proven best practice, thus providing confidence that future performance will be consistent with past accomplishments
Review and adjust the required process attribute ratings for each initial process	Add attribute ratings for level 4 or level 5; or remove attribute ratings for level 3	Adding level 4 and level 5 process attributes for some processes may sometimes be justified to reduce process-related risks, as illustrated in Figure 1 where the target process profile for TEC.4 Architecture Definition includes process attributes from capability level 4 Sometimes, deleting process attributes from level 3 may be justified, as illustrated in Figure 2, where the target process profile for DEV.1 Software Requirements Analysis includes process attribute from capability levels 1 and 2 only The target capability for Technical Management Processes and Organizational Project Enabling Processes is driven by the extent to which they support process attributes applying to the initial set of selected processes Other Technical Management Processes and Organizational Project Enabling Processes should also be included in the target capability statement where they are relevant to the specified requirement (for process risk determination)

Note that the target process profile may need to address specific organizational process attribute ratings, rather than the development of a product or service. The requirement may, for example, be to establish a strong configuration management process as an end in itself, and the selected process set would then include this single process. A detailed description of the process for definition of a target process profile is given in Annex C.

6.5 Guidelines for assessments used for process risk determination

6.5.1 General

As described in 4.3.3 specific guidelines may be established by the organization or by a community of interest to increase the significance and comparability of the process risk determination results. This should include the following elements:

— a definition of the scope of the rating guideline;

— categories of different risk types;

— recommendations for determining the target assessment input;

— criteria for data and information collection for specific types of risks;

— rating rules or recommendations with respect to specific types of risks; and

— recommendations on the necessary skills of assessors especially for the lead assessor.

6.5.2 Specific guidelines on determining the target assessment input

The definition of an appropriate target assessment input is an important criterion for the significance of the results of the process risk determination. An organization or community of interest may set up specific recommendations for selecting the target assessment input with respect to defined type of risks matching the specific requirements for the process risk determination. This might include recommendations for:

— a process assessment model matching the organization or domain context;

— a standard process selection from the process assessment model with respect to the defined type of risks to be determined;

— a method to define the target process context with respect to the defined type of risks to be determined;

— a certification scheme to justify the skills of assessors.

6.5.3 Specific criteria for data and information collection

Specific criteria for data and information collection can support the significance of the process risk determination results. These criteria may be defined with respect to the objectives of the process risk determination, thus then being aligned to defined types of risks under investigation. The criteria should include:

— the quantity and type of objective evidence needed to support each process attribute rating;

— the consideration of the process context when selecting objective evidence;

— the class of assessment including the necessary independence of the assessors.

For example, when determining process-related risks for the quality of the product, the guideline may require expressing the process context in terms of a specific set of stakeholder requirements valid for a specific release of the product. In this case the guideline may require that every process attribute rating may be considering the extent of achievement of the process outcomes with respect to the given set of stakeholder requirements. The guideline may also specify that the quantity and type of objective evidence is appropriate to achieve a sufficient coverage of the given set of stakeholder requirements.

For a supplier process risk determination, the guideline may for example require that every process attribute rating be supported by a minimum of three verbal assertions collected at different data collection sessions plus at least one piece of documentary evidence; the guideline may also specify

that if a document has been formally requested by a competent assessor but the organizational unit has stated that it cannot be produced, then this assertion may be counted in lieu of the documentary evidence required.

6.5.4 Specific rating rules or recommendations

A guideline set up by the organization or a community of interest may also define specific rating rules or recommendations for a defined process assessment model. These rules and recommendations should consider the dependencies of process attribute ratings

— between different processes on the same quality level;

— within processes on different quality levels; and

— between different processes on different quality levels.

6.6 Evaluating process-related risk

6.6.1 Inferring process-related risk from assessment output

The quality of a product or service is greatly influenced by the processes deployed to provide it. Process quality characteristics can be evaluated using the approach defined in ISO/IEC 33002; for example, process capability is measured via the process attributes described in ISO/IEC 33020. Process-related risk arises from inappropriate process management, i.e. not deploying appropriate processes, or from deploying those in a way which does not achieve required process attribute ratings.

The output of a conformant process assessment includes a set of process profiles. Required process attributes can be represented as a set of target process profiles, as described in 6.4 and illustrated in Figure 2.

Both target and assessed process profiles can be presented within a single diagram, as illustrated in Figure 3. Again, the process attributes (PA 1.1 etc) and ratings (Fully achieved etc) are defined in ISO/IEC 33020.

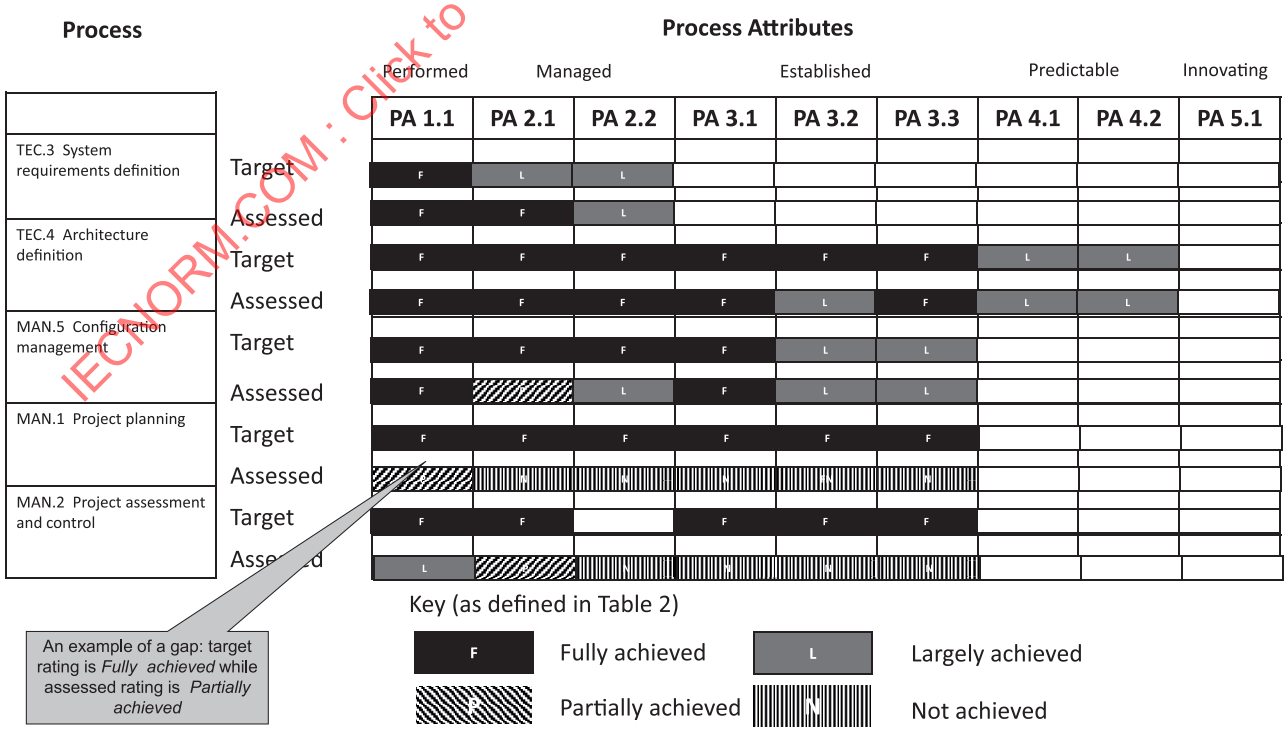

Figure 3 — Target and assessed process profiles

Process-related risk can be inferred from the existence of gaps between a target process profile and an assessed process profile. A gap is said to exist if:

— the target process profile requires that a particular process attribute be Fully achieved, while the assessed process attribute rating is less than Fully achieved;

— the target process profile requires that a particular process attribute be Largely achieved, while the assessed process attribute rating is less than Largely achieved.

The potential consequence of a gap depends upon the process quality level and process attribute where the gap occurs - as illustrated in Table 4, where the process attributes (PA 1.1 etc) are defined in ISO/IEC 33020.

Table 4 — Potential consequence of process attribute gaps

Process attribute where gap occurs	Potential consequence
PA 1.1 Process performance	— missing information products; process outcomes not achieved
PA 2.1 Performance management	— cost or time overruns; inefficient use of resources — unclear responsibilities, uncontrolled decisions, and uncertainty over whether time and cost objectives will be met
PA 2.2 Documented information management	— unpredictable product quality and integrity, uncontrolled versions, increased support costs, integration problems and increased re-work costs
PA 3.1 Process definition	— identified best practice and lessons learned from previous projects not defined, published and available within organization — no foundation for organization-wide process improvement
PA 3.2 Process deployment	— implemented process not incorporating identified best practice and lessons learned from previous projects; inconsistent process performance across organization — required documented information is not available
PA 3.3 Process assurance	— loss of effectiveness — nonconformities are not addressed — lost opportunities to understand process and identify improvements
PA 4.1 Quantitative analysis	— no quantitative understanding of how well process performance objectives and defined business goals are being achieved — no quantitative ability to detect performance problems early
PA 4.2 Quantitative control	— process performance is not stable or predictable — quantitative performance objectives and defined business goals not met
PA 5.1 Process Innovation	— opportunities for improvement not clearly identified — inability to change process effectively to achieve relevant process improvement objectives

Process-related risk is assessed from the probability of a problem arising from an identified gap, and from its potential consequence, should it occur. A chosen process risk determination method should

contain a defined approach to analysing process-related risk. An example approach is illustrated at Annex B.

6.6.2 Analysing weaknesses

Whenever a gap is identified, a weakness is said to exist. For each identified gap, the analysis team may determine and record, with respect to the specified requirement or business goals:

— the nature of the weakness;

— the source or cause of the weakness;

— the potential consequences of the weakness.

6.7 Using process risk determination for supplier selection

A process risk determination can provide a fundamental input to a supplier selection process, for example, AGR.1 - Acquisition. One of the outcomes of this process is that one or more suppliers are selected based upon the evaluation of the supplier's proposals, process capabilities, and other factors. An acquirer may initiate a process risk determination to assess the risk of entering into a contract with a single supplier, or an acquirer may carry out process risk determinations on a number of competing suppliers during a supplier selection activity.

Suppliers may also wish to carry out a process risk determination on their own processes before deciding whether to bid for a contract, as part of their assessment of the business risks involved. A process risk determination may also be initiated for a number of other reasons; for example, by a supplier during the course of a project to establish the risks involved in completing the work.

Both self-assessment and independent assessment approaches may be used to assess current achievement of the relevant process quality characteristic during Step 3 of a process risk determination. In a two-party contractual situation, an acquirer may invite the potential suppliers to provide a self-assessment set of process profiles when submitting a proposal for a contract. The set of process profiles should have been produced from a conformant assessment against a specified process reference model.

The acquirer may then choose to:

— accept the self-assessment at face value;

— initiate and rely entirely upon a full independent assessment, possibly using assessors from his own organization and make this a condition of contract award;

— initiate a limited independent assessment to verify that the self-assessment is a true representation of the supplier's current process quality characteristics. This approach offers the benefit of reducing disruption to suppliers' business activities caused by multiple process assessments, since the same assessment output may be offered to many acquirers. It also provides acquirers with a rigorous and defensible approach to supplier process risk determination, and the potential to reduce assessment costs through the reuse of results and the utilization of self-assessments.

6.8 Comparability of assessment output analysis

If the process risk determination is part of a supplier selection process involving a number of competing suppliers, then the process risk determination team may need to compare the process-related risk associated with each supplier's process quality characteristics.

Comparison of the outputs of different conformant process assessments is always carried out by comparing process profiles, and is only possible if they all include the same selected processes from the same process reference model(s) and are based on a comparable assessment input including the process context.

A number of factors also need to be considered carefully in order to determine whether a comparison of the outputs of different conformant assessments is valid. These factors also affect the validity of comparing process-related risks identified from analysis of the outputs of different conformant assessments.

These factors include but are not limited to:

— the conformant process assessment model used;

— the assessment process used;

— the quantity and type of objective evidence used to determine the set of process profiles; the identity, skills, knowledge and experience of the assessors.

Annex A
(informative)

Categorizing types of process-related risks

A.1 General

As described in 4.3.2, the significance of the process risk determination results may be supported by analysing and categorizing specific type of risks to provide input for the sub-sequent steps. This may be done by mapping identified risk root causes to deficits in the achievement of process quality attributes.

As an example, the categorization as shown in Table A.1 can be established:

Table A.1 — Exemplary process-related risk type categorisation

Risk type category	Risk type	Possible risk root causes	Possible effects
A	Product quality risk	— Missing or inadequate information products — Inconsistency in information products — Lack in supplier's performance	— Inacceptable product quality — Stakeholder or legal requirements are not covered — Customer dissatisfaction — Safety incidents — Security incidents
B	Present organizational risk	— Standard processes are not defined — Missing deployment of standard processes — Standard processes not appropriate	— Time or cost overruns — No uniformity of performance over time or in different organizational units — Reduced efficiency in the performance of processes — Duplicate work / Re-inventing the wheel — Synergy effects are missed — Cooperation barriers between organizational units
C	Future organizational risk	— Deployed processes are not quantitatively measured — Standard processes are not improved — Standard processes are not aligned to the organizations business goals	— Reduction in ability to predict performance — Reduction in ability to detect problems with the application of the standard processes in time — Reduction in cost/time/resource optimisation of the standard processes — Reduction in ability to cope with changes in technology

In the following clauses exemplary mappings and associated arguments are given based the defined process capability level of ISO/IEC 33020.

A.2 Category A: Process-related risks for the quality of the product

In Tables A.2 to A.4 the classification of risk types has been done based on the following indications:

++	A deficit in the achievement of this process quality attribute gives significant evidence for the identified risk type.
+	A deficit in the achievement of this process quality attribute gives additional evidence for the identified risk type.
o	A deficit in the achievement of this process quality attribute is unlikely to give evidence for the identified risk type.

Table A.2 — Category A: Coverage of root cause by process attributes

Risk type category	Risk root cause	Level 1	Level 2	Level 3	Level 4	Level 5
A	Missing or inadequate information products	++	++	+	o	o
	Inconsistency in information products	++	++	+	o	o
	Lack in supplier's performance	++	+	o	o	o
A	Inadequate management of activities or information products	++	++	+	o	o

EXAMPLE Determine process-related risk for a specific release of the product.

The result of a process capability assessment using the process measurement framework defined in ISO/IEC 33020 can give evidence for process-related risks impacting the quality of a specific product release.

For determining a process-related product risk, important criteria are:

— to which extent a given set of top-level requirements and changes associated with a release of the product have been processed correctly and completely by affected processes;

— whether the performance of these affected processes is accompanied by an appropriate set of additional processes; and

— whether the performance of these processes and associated information products are adequately managed.

This leads to the conclusion that gaps in the achievement of the process attributes PA 1.1, PA 2.1 and PA 2.2 are significant indicators for the quality of a specific release of the product.

When determining the process context to set up the target assessment input and the aligned target process profile, the set of top-level requirements and changes associated with a certain release of the product provide a reasonable outline.

When rating the process attribute PA 1.1, the extent of achievement of the process outcomes should be rated with respect to the given set of stakeholder requirements. The quantity and type of objective evidence should be appropriate to achieve a sufficient coverage of the given set of stakeholder requirements.

NOTE The determination of type A risks for a given product development can give valuable input for process improvement actions in order to mitigate the risks until the final release of the product.

A.3 Category B: Present organizational risks

Table A.3 — Category B: Coverage of root cause by process attributes

Risk type category	Risk root cause	Level 1	Level 2	Level 3	Level 4	Level 5
B	Missing definition of standard processes	o	o	++	o	o
	Missing deployment of standard processes	o	o	++	o	o
	Standard processes are not appropriate	+	+	++	o	o

EXMAPLE Determine process-related risk for the organization

The result of a process capability assessment using the process measurement framework defined in ISO/IEC 33020 can give evidence for process-related risks impacting the current achievement of business goals of the organization.

For determining current process-related risks for the organization, important criteria are,

— to which extent the standard processes are defined;

— to which extent the standard processes are deployed; and

— to which extent the defined processes are effective and suitable.

This leads to the conclusion that gaps in the achievement of the process attributes PA 3.1, 3.2, 3.3 and partially PA 1.1, 2.1 and 2.2 are significant indicators for present risks for the organization. Gaps in the achievement of PA 3.1, 3.2 and 3.3 are directly contributing to the forenamed risks, whether the gaps in the performance and management of these processes (PA 1.1, 2.1 and 2.2) may provide evidence for a lack in efficiency or suitability of the defined processes.

When determining the process context to set up the target assessment input and the aligned target process profile, it should be aligned to the predominant application of processes in the organization. In this case the target assessment input should be applicable for a significant number of developments to allow a substantiated conclusion.

NOTE 1 The determination of type B risks in an organization can give valuable input for process improvement actions in order to optimize the definition and the deployment of standard processes in the organization.

NOTE 2 An organizational maturity assessment can give a more detailed approach to achieve coverage of the different organizational units.

A.4 Category C: Future organizational risks

Table A.4 — Category C: Coverage of root cause by process attributes

Risk type category	Risk root cause	Level 1	Level 2	Level 3	Level 4	Level 5
C	Deployed processes are not quantitatively measured	o	o	+	++	++
	Standard processes are not improved	o	o	+	++	++
	Standard processes are not aligned to the organizations business goals	o	o	+	++	++

EXAMPLE Determine process-related risk for the evolution of the organization.

The result of a process capability assessment using the process measurement framework defined in ISO/IEC 33020 can give evidence for process-related risks impacting the future achievement of business goals of the organization.

This leads to the conclusion, that gaps in the achievement of the process attributes PA 4.1, 4.2, and 5.1 and partially PA 3.1, 3.2 and 3.3 are significant indicators for future risks for the organization. Gaps in the achievement of PA 4.1 to PA 5.1 are directly contributing to the forenamed risks.

When determining future process-related risks for the organization, it can be assumed that the standard processes are already defined, deployed, and aligned to the predominant application of processes in the organization. Gaps in the definition deployment and assurance of these processes (PA 3.1, 3.2 and 3.3) may provide evidence that this assumption is not correct.

When determining future process-related risks for the organization, the process context plays only a minor role. Any assessment should focus on the complete set of standard processes, which will define the set of processes under investigation in the target assessment input.

Annex B
(informative)

Analysing process-related risks

B.1 General

In the example approach to analysing process-related risk described within this Annex, process-related risk is assessed on a process-by-process basis, and inferred from the existence of gaps between a target process profile and an assessed process profile.

For each process, a gap is said to exist:

— if the target process profile requires that a particular process attribute be Fully achieved, while the assessed process attribute rating is less than Fully achieved;

— if the target process profile requires that a particular process attribute be Largely achieved, while the assessed process attribute rating is less than Largely achieved.

Overall risk associated with each process is then derived from the probability of a problem arising from an identified gap, and from its potential consequence, should it occur.

B.2 Probability

The probability of a problem occurring is derived from the extent of any gaps between a target process profile and an assessed process profile.

Process attribute gaps occur whenever an assessed process attribute rating falls short of a required process attribute rating. Process attribute gaps can be designated as shown in Table B.1.

Table B.1 — Process attribute gaps

Required process attribute rating	Assessed process attribute rating	Process attribute gap
Fully achieved	Fully achieved	None
	Largely achieved	Minor
	Partially achieved	Major
	Not achieved	Major
Largely achieved	Fully achieved	None
	Largely achieved	None
	Partially achieved	Major
	Not achieved	Major

The probability of a problem occurring depends upon the extent of the process attribute gaps, and upon the process quality levels where they occur, as designated in Table B.2.

As shown in the table, the highest probability of a problem occurring is associated with a substantial process quality level gap, arising from either a major process attribute gap at level 1, or more than one major gap within levels 2 to 5. A single minor gap at level 1, or more than one major gap within levels 2 to 5, represents a significant process quality level gap and a moderate chance of a problem occurring.

Minor gaps within levels 2 to 5 represent a slight process quality level gap and a lower probability of a problem occurring.

Table B.2 — Process quality level gaps

Number of process attribute gaps and process quality level	Process quality level gap	Probability of problem occurring
No major or minor gaps	**None**	Lowest
No gap for level 1, and only minor gaps within levels 2, 3, 4 or 5	**Slight**	
A minor gap for level 1, or a single major gap within levels 2, 3, 4 or 5	**Significant**	
A major gap at level 1, or more than one major gap within levels 2, 3, 4 or 5	**Substantial**	Highest

B.3 Consequence

The potential consequences associated with individual process attribute gaps are illustrated in Table 4. However, for the purposes of analysing process-related risk as described within this Annex, the seriousness of the consequences depends on the process quality level within which the gaps occur, as shown in Table B.3.

For example, if a selected process is assessed less than fully performed, i.e. PA 1.1 is not Fully achieved, then process outcomes may not be achieved - the most serious consequence.

Table B.3 — Consequence of a problem occurring

Process quality level where gap occurs	Nature of consequence	Seriousness of Consequence
5 - Innovating process	inability to achieve or evaluate process improvements	Lowest
4 - Predictable process	inability to quantify performance or detect problems early	
3 - Established process	inconsistent process performance across organization	
2 - Managed process	cost or time overruns; unpredictable product quality	
1 - Performed process	missing information products; process outcomes Not achieved	Highest

B.4 Process-related risk

The process-related risk associated with each process depends upon the probability of problem arising from an identified gap, and upon the potential consequence, should it occur.

The highest risk arises from a substantial gap at a lower process capability level - as shown in Table B.4.

If risks are identified within more than one process capability level, then the highest capability quality level risk is taken to be the process-related risk for the process.

Table B.4 — Risk associated with each process capability level

Consequence indicated by process capability level where gap occurs	*Probability indicated by extent of process capability level gap*		
	Slight	**Significant**	**Substantial**
5 - Innovating process	Low Risk	Low Risk	Low Risk
4 - Predictable process	Low Risk	Low Risk	Medium Risk
3 - Established process	Low risk	Medium Risk	Medium Risk
2 - Managed process	Medium Risk	Medium Risk	**High Risk**
1 - Performed process	Medium Risk	**High risk**	**High Risk**

B.5 Determining which processes represent greatest risk

The process-related risk associated with each process can now be tabulated as illustrated in Table B.4, and the process or processes representing the greatest degree of risk can be identified.

If several processes represent the same high degree of risk, then professional judgement will be required to determine, with respect to the specified requirement, which processes will be most critical to success. Although Technical processes will often be most critical, this should not be taken for granted, since there may be occasions when support processes will be as critical, if not more critical.

B.6 Analysis approach

For each process, the analysis team:

— examines each process attribute within the target process profile, and designates any process attribute gaps using Table B.1;

— considers the process attribute gaps and designates any process capability level gaps using Table B.2;

— identifies the potential process-related risk associated with each process capability level gap from Table B.4;

— identifies which process capability level gap constitutes the highest degree of risk, and takes this to represent the process-related risk for the process.

The analysis team then determines which process or processes represent the greatest degree of risk. If more than one process represents the same degree of risk, risks may be prioritized based on factors external to the process activities, such as the importance of risk to the organization and the probability of risk occurrence.

B.7 Example risk analysis

B.7.1 General

This example analysis uses the set of output process profiles illustrated in 4.3 and the set of target process profiles illustrated in 6.3.5, as shown in Figure B.1.

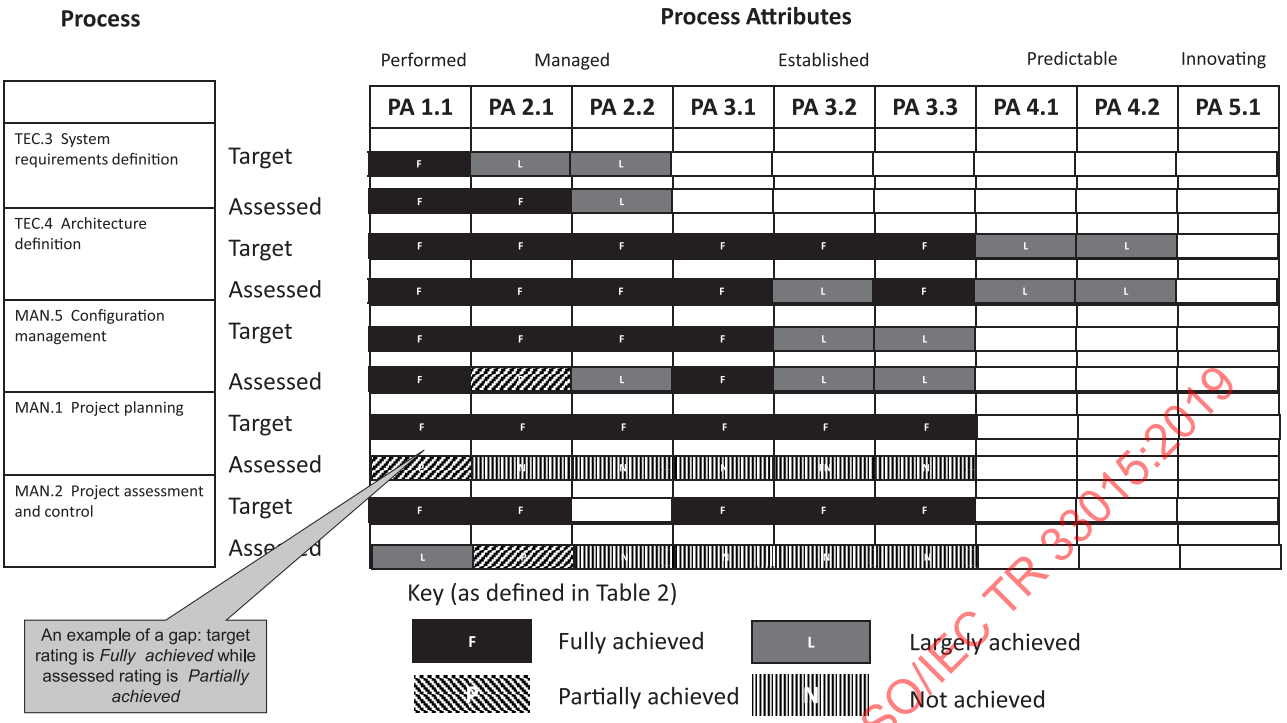

Figure B.1 — Target and assessed process profiles

B.7.2 TEC.4 Architecture Definition

Table B.5 — Architecture Definition process-related risk analysis

	Level 1	Level 2		Level 3			Level 4	
	PA 1.1	PA 2.1	PA 2.2	PA 3.1	PA.3.2	PA 3.3	PA 4.1	PA 4.2
Target profile	F	F	F	F	F	F	L	L
Assessed profile	F	F	F	F	L	F	L	L
Process attribute gap	—	—	—	—	minor	—	—	—
Process quality level gap	—	—		slight			—	
Process quality level risk	—	—		low			—	
Process-related risk	—	low						

The profiles are shown in Table B.5; this shows that the only process attribute gap is at PA 3.2.

— according to Table B.1 this is designated as a minor process attribute gap;

— according to Table B.2, a single minor process attribute gap at level 3 constitutes a slight process capability level gap;

— according to Table B.4, a slight gap at level 3 represents a low degree of risk;

— the process-related risk associated with the Architectural Definition process is therefore low.

B.7.3 MAN.5 Configuration Management

Table B.6 — Configuration Management process-related risk analysis

	Level 1	Level 2		Level 3			Level 4	
	PA 1.1	PA 2.1	PA 2.2	PA 3.1	PA 3.2	PA 3.3	PA 4.1	PA 4.2
Target profile	F	F	F	L	L	L	—	—
Assessed profile	F	P	L	F	L	L	—	—
Process attribute gap	—	major	minor	—		—	—	—
Process quality level gap	—	significant		—			—	
Process quality level risk	—	medium		—			—	
Process-related risk	—	medium						

The profiles are shown in Table B.6; this shows process attribute gaps at PA 2.1 and PA 2.2.

— according to Table B.1 these are designated major and minor process attribute gaps respectively;

— according to Table B.2, a single major process attribute gap at level 2 represents a significant process capability level gap;

— according to Table B.4, a significant gap at level 2 represents a medium degree of risk;

— the process-related risk associated with the Configuration Management process is therefore medium.

B.7.4 MAN.1 Project Planning

Table B.7 — Project Planning process-related risk analysis

	Level 1	Level 2		Level 3			Level 4	
	PA 1.1	PA 2.1	PA 2.2	PA 3.1	PA 3.2	PA 3.3	PA 4.1	PA 4.2
Target profile	F	F	F	F	F	F	—	—
Assessed profile	P	N	N	N	N	N	—	—
Process attribute gap	major	major	major	major	major	major	—	—
Process quality level gap	substantial	substantial		substantial			—	
Process quality level risk	high	high		medium			—	
Process-related risk		high						

The profiles are shown in Table B.7; this shows process attribute gaps within 6 process attributes.

— according to Table B.1, all 6 are designated major process attribute gaps;

— according to Table B.2, a single major process attribute gap at level 1 represents a substantial process quality level gap; 2 major process attribute gaps at level 2 represent another substantial process quality level gap; 3 major process attribute gaps at level 3 also represents a further substantial process quality level gap;

— according to Table B.4, substantial process capability level gaps at both levels 1 and 2 represent a high degree of risk; a substantial process capability level gap at level 3 represents a medium degree of risk;

— the process-related risk associated with the Project Planning process is therefore high.

Annex C
(informative)

Target process profiles

C.1 General

The value of a target process profile is its ability to clearly address process risk determination needs in Clause 6. The set of target process profiles expresses the target process quality characteristic achievement which the sponsor judges to be adequate, subject to an acceptable process-related risk, for meeting the defined business requirements (see NOTE 1). A target process profile is derived from the defined business requirements, traceable to one or more process practice indicators and one or more process quality characteristic indicators that meet these requirements. These in turn enable the sponsor to select the appropriate process attributes and a required rating for each process attribute or select the appropriate process quality level and process quality level rating.

In general, it is recommended that the sponsor select one or more existing process reference models and use the processes in the selected models as the basis for determining the process quality characteristic of each selected process within the models. Should additional processes need to be defined to meet business requirements, the sponsor has two options:

1) define the process to demonstrate conformance as required in ISO/IEC 33004 in order to have a conformant target process profile, or

2) where the process does not meet ISO/IEC 33004 requirements, use the target process profile while noting it is nonconforming for process risk determination purposes.

As a result, a set of target process profiles will consist of a set of processes and process attribute ratings applicable to the intended use. A set of target process profiles cannot be generic (e.g. all processes to be process capability level 2 or process capability level 3) as this will not meet the specific application defined by its intended use. This form of generic profile will not address the specified business requirement, domain of application and characterization nor specifically determine the indicators of process performance and process quality characteristic achievement that meet the intended use (see NOTE 2).

NOTE 1 The sponsor can appoint persons or teams to perform the work in defining and using target process profiles.

NOTE 2 Software that needs to meet human safety critical business requirements (i.e. a specific domain of application) has different requirements to software used to create personal web sites. Within any domain of application, some of the selected processes will need to be at higher process quality levels in order to achieve acceptable process-related risk, while the other selected processes that have less effect on the process-related risk should be effective at lower process quality levels.

NOTE 3 A maturity level in an organization maturity model can be composed from a set of target process profiles.

C.2 Defining a target process profile

C.2.1 General

The ten steps associated with defining a target process profile are:

— Define the purpose