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Quality management systems — Guidelines for quality management in projects

*Systemes de management de la qualite — Lignes directrices pour le
management de la qualite dans les projets*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 10006 was prepared by Technical Committee ISO/TC 176, *Quality management and quality assurance*, Subcommittee SC 2, *Quality systems*.

This second edition cancels and replaces the first edition (ISO 10006:1997), which has been technically revised.

This edition has sought to improve the alignment of ISO 10006 with the ISO 9000 family of International Standards, and includes new text concerning their quality management principles. Also, the title of ISO 10006 has been revised to reflect the changes to the ISO 9000 family of International Standards and to give an improved expression of the aim of this International Standard.

Introduction

This International Standard provides guidance on quality management in projects. It outlines quality management principles and practices, the implementation of which are important to, and have an impact on, the achievement of quality objectives in projects. It supplements the guidance given in ISO 9004.

These guidelines are intended for a wide audience. They are applicable to projects which can take many forms from the small to very large, from simple to complex, from being an individual project to being part of a programme or portfolio of projects. They are intended to be used by personnel who have experience in managing projects and need to ensure that their organization is applying the practices contained in the ISO 9000 family of standards, as well as those who have experience in quality management and are required to interact with project organizations in applying their knowledge and experience to the project. Inevitably, some groups will find that material presented in the guidelines is unnecessarily detailed for them, however other readers may be dependent on the detail.

It is recognized that there are two aspects to the application of quality management in projects; that of the project processes and that of the project's product. A failure to meet either of these dual aspects may have significant effects on the project's product, the project's customer and other interested parties, and the project organization.

These aspects also emphasize that the achievement of quality objectives is a top management responsibility, requiring a commitment to the achievement of quality objectives to be instilled at all levels within the organizations involved in the project. However, each level should retain responsibility for their respective processes and products.

The creation and maintenance of process and product quality in a project requires a systematic approach. This approach should be aimed at ensuring that the stated and implied needs of the customer are understood and met, that other interested parties' needs are understood and evaluated, and that the originating organization's quality policy is taken into account for implementation in the management of the project.

It should be noted that a summary of processes in projects is given in Annex A.

Quality management systems — Guidelines for quality management in projects

1 Scope

This International Standard gives guidance on the application of quality management in projects.

It is applicable to projects of varying complexity, small or large, of short or long duration, in different environments, and irrespective of the kind of product or process involved. This can necessitate some tailoring of the guidance to suit a particular project.

This International Standard is not a guide to “project management” itself. Guidance on quality in project management processes is discussed in this International Standard. Guidance on quality in a project’s product-related processes, and on the “process approach”, is covered in ISO 9004.

Since this International Standard is a guidance document, it is not intended to be used for certification/registration purposes.

2 Normative references

The following referenced documents are indispensable for the application 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 9000:2000, *Quality management systems — Fundamentals and vocabulary*

ISO 9004: 2000, *Quality management systems — Guidelines for performance improvements*

NOTE The Bibliography contains additional references applicable to quality management in projects.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9000 and the following apply. Some of the definitions below are quoted directly from ISO 9000:2000, but are also supplemented with notes specific to projects.

3.1

activity

⟨project⟩ smallest identified item of work in a **project** (3.5) **process** (3.3)

3.2

interested party

person or group having an interest in the performance or success of an organization

EXAMPLE Customers, owners, people in an organization, suppliers, bankers, unions, partners or society.

NOTE 1 A group can comprise an organization, a part thereof, or more than one organization.

[ISO 9000:2000, definition 3.3.7]

NOTE 2 Interested parties may include

- customers (of the project's products),
- consumers (such as a user of the project's product),
- owners of the project (such as the organization originating the project),
- partners (as in joint-venture projects),
- funders (such as a financial institution),
- suppliers or subcontractors (e.g. organizations supplying products to the project organization),
- society (such as jurisdictional or regulatory bodies and the public at large), and
- internal personnel (such as members of the project organization).

NOTE 3 There can be conflicting interests among interested parties. These may need to be resolved for the project to be successful.

3.3 process

set of interrelated or interacting activities which transforms inputs into outputs

NOTE 1 Inputs to a process are generally outputs of other processes.

NOTE 2 Processes in an organization are generally planned and carried out under controlled conditions to add value.

[ISO 9000:2000, definition 3.4.1 (excluding Note 3)]

3.4 progress evaluation

assessment of progress made on achievement of the **project** (3.5) objectives

NOTE 1 This assessment should be carried out at appropriate points in the project life cycle across project processes, based on criteria for project processes and product.

NOTE 2 The results of progress evaluations may lead to revision of the **project management plan** (3.7).

3.5 project

unique process, consisting of a set of coordinated and controlled **activities** (3.1) with start and finish dates, undertaken to achieve an objective conforming to specific requirements, including the constraints of time, cost and resources

[ISO 9000:2000, definition 3.4.3 (excluding Notes)]

NOTE 1 An individual project may form part of a larger project structure.

NOTE 2 In some projects the objectives and scope are updated and the product characteristics defined progressively as the project proceeds.

NOTE 3 The project's product (see ISO 9000:2000, 3.4.2) is generally defined in the project scope (see 7.3.1). It may be one or several units of product and may be tangible or intangible.

NOTE 4 The project's organization is normally temporary and established for the lifetime of the project.

NOTE 5 The complexity of the interactions among project activities is not necessarily related to the project size.

3.6**project management**

planning, organizing, monitoring, controlling and reporting of all aspects of a **project** (3.5) and the motivation of all those involved in it to achieve the project objectives

3.7**project management plan**

document specifying what is necessary to meet the objective(s) of the **project** (3.5)

NOTE 1 A project management plan should include or refer to the project's **quality plan** (3.8).

NOTE 2 The project management plan also includes or references such other plans as those relating to organizational structures, resources, schedule, budget, risk management, environmental management, health and safety management and security management, as appropriate.

3.8**quality plan**

document specifying which procedures and associated resources shall be applied by whom and when to a specific **project** (3.5), product, **process** (3.3) or contract

NOTE 1 These procedures generally include those referring to quality management processes and to product realization processes.

NOTE 2 A quality plan often makes reference to parts of the quality manual or to procedure documents.

NOTE 3 A quality plan is generally one of the results of quality planning.

[ISO 9000:2000, definition 3.7.5]

3.9**supplier**

organization or person that provides a product

EXAMPLE A producer, distributor, retailer or vendor of a product, or a provider of a service or information.

NOTE 1 A supplier can be internal or external to the organization.

NOTE 2 In a contractual situation a supplier is sometimes called a "contractor".

[ISO 9000:2000, definition 3.3.6]

NOTE 3 In the context of projects, "contractor" or "subcontractor" is often used in place of "supplier".

4 Quality management systems in projects**4.1 Project characteristics****4.1.1 General**

Some of the characteristics of projects are as follows:

- they are unique, non-repetitive phases consisting of processes and activities;
- they have some degree of risk and uncertainty;
- they are expected to deliver specified (minimum) quantified results within predetermined parameters, for example, quality-related parameters;
- they have planned start and finishing dates, within clearly specified cost and resource constraints;

- personnel may be temporarily assigned to a project organization for the duration of the project [the project organization may be assigned by an originating organization (see 4.1.2) and may be subject to change as the project progresses];
- they may be of a long duration, and subject to changing internal and external influences over time.

4.1.2 Organizations

This International Standard makes separate reference to an “originating organization” and to a “project organization”.

The “originating organization” is the organization that decides to undertake the project. It may be constituted as a single organization, joint-venture, consortium, etc. The originating organization assigns the project to a project organization. The originating organization may be undertaking multiple projects, each of which may be assigned to a different project organization.

The “project organization” carries out the project. The project organization may be a part of the originating organization.

4.1.3 Processes and phases in projects

Processes and phases are two different aspects of a project. A project may be divided into interdependent processes and into phases as a means of planning and monitoring the realization of objectives and assessing the related risks.

Project phases divide the project life cycle into manageable sections, such as conception, development, realization and termination.

Project processes are those processes that are necessary for managing the project as well as those that are necessary to realize the project’s product.

Not all the processes discussed in this International Standard will necessarily exist in a particular project, whereas in others, additional processes may be necessary. In some projects, a distinction may need to be made between core and supporting processes. Annex A lists and summarizes the processes that are considered to be applicable for the majority of projects.

NOTE To facilitate the discussion of the guidance to quality management in projects, the “process approach” is adopted in this International Standard. Additionally, the processes of a project have been grouped into two categories: the project management processes and the processes related to the project’s product (those primarily concerned with the project’s product such as design, production, etc.).

The processes are grouped according to their affinity to one another, for example all time-related processes are included in one group. Eleven groups of processes are presented.

The strategic process covered in Clause 5 sets the direction for the project. Clause 6 addresses resource-related processes and personnel-related processes. Clause 7 covers processes related to interdependency, scope, time, cost, communication, risk and purchasing. Processes related to measurement and analysis, and continual improvement, are covered in Clause 8. These clauses include a description of each process and provide guidance to quality management in the process.

4.1.4 Project management processes

Project management includes the planning, organizing, monitoring, controlling, reporting and taking necessary corrective actions on all processes of the project that are needed to achieve the project objectives, on a continual basis. The quality management principles (see 4.2.1 and 5.2, and ISO 9000:2000, 0.2) should be applied to all the project management processes.

4.2 Quality management systems

4.2.1 Quality management principles

The guidance for quality management of projects in this International Standard is based on eight quality management principles (see ISO 9000:2000, 0.2):

- a) customer focus;
- b) leadership;
- c) involvement of people;
- d) process approach;
- e) system approach to management;
- f) continual improvement;
- g) factual approach to decision making;
- h) mutually beneficial supplier relationships.

These generic principles should form the basis for quality management systems for the originating and project organizations.

NOTE Guidance on the application of the quality management principles to the planning carried out in the strategic process is given in 5.2.2 to 5.2.9.

4.2.2 Project quality management system

It is necessary to manage project processes within a quality management system in order to achieve project objectives. The project quality management system should be aligned, as far as is possible, with the quality management system of the originating organization.

NOTE ISO 9004 provides guidelines for considering both effectiveness and efficiency of quality management systems.

Documents needed and produced by the project organization to ensure the effective planning, implementation and control of the project should be defined and controlled (see ISO 9004:2000, 4.2).

4.2.3 Quality plan for the project

The project quality management system should be documented and included or referenced in a quality plan for the project.

The quality plan should identify activities and resources necessary for achieving the quality objectives of the project. The quality plan should be incorporated into, or referenced in, the project management plan.

In contractual situations, a customer may specify requirements for the quality plan. These requirements should not limit the scope of the quality plan used by the project organization.

NOTE ISO 10005 gives guidance on quality plans.

5 Management responsibility

5.1 Management commitment

The commitment and active involvement of the top management of the originating and project organizations are essential for developing and maintaining an effective and efficient quality management system for the project.

Top management of both the originating and project organizations should provide input into the strategic process (see 5.2).

Since the project organization may be dispersed on completion of the project, the top management of the originating organization should ensure that continual improvement actions are implemented for current and future projects.

Top management of the originating and project organizations need to create a culture for quality, which is an important factor in ensuring the success of the project.

5.2 Strategic process

5.2.1 Application of quality management principles through the strategic process

Planning for the establishment, implementation and maintenance of a quality management system based on the application of the quality management principles is a strategic, direction-setting process. This planning should be performed by the project organization.

In this planning, it is necessary to focus on the quality of both processes and products to meet the project objectives.

The general guidance given in 5.2.2 to 5.2.9 should also be applied to the processes described in 6.1, 6.2, 7.2 to 7.8, and in Clause 8, in addition to the specific guidance given in those clauses.

5.2.2 Customer focus

Organizations depend on their customers and therefore should understand current and future customer needs, should meet customer requirements and strive to exceed customer expectations [see ISO 9000:2000, 0.2a)].

Satisfaction of the customers' and other interested parties' requirements is necessary for the success of the project. These requirements should be clearly understood to ensure that all processes focus on, and are capable of, meeting them.

The project objectives, which include the product objectives, should take into account the needs and expectations of the customer and other interested parties. The objectives may be refined during the course of the project. The project objectives should be documented in the project management plan (see 7.2.2) and should detail what is to be accomplished (expressed in terms of time, cost and product quality) and what is to be measured.

When determining the balance between time or cost and product quality, potential impacts on the project's product should be evaluated, taking into consideration customers' requirements.

Interfaces should be established with all the interested parties to facilitate the exchange of information, as appropriate, throughout the project. Any conflicts between interested party requirements should be resolved.

Normally, when conflicts arise between the requirements of the customer and other interested parties, customer requirements take precedence, except in the case of statutory or regulatory requirements.

Resolution of conflicts should be agreed to by the customer. Interested party agreements should be documented. Throughout the project, attention will need to be paid to changes in the requirements of the

interested parties, including additional requirements from new interested parties that join the project after it has commenced.

5.2.3 Leadership

Leaders establish unity of purpose and direction of the organization. They should create and maintain the internal environment in which people can become fully involved in achieving the organization's objectives [see ISO 9000:2000, 0.2b)].

A project manager should be appointed as early as possible. The project manager is the individual with the defined responsibility and authority for managing the project and ensuring that the project's quality management system is established, implemented and maintained. The authority delegated to the project manager should be commensurate with the assigned responsibility.

The top management of both the originating and the project organizations should assume leadership in creating a culture for quality

- by setting the quality policy and identifying the objectives (including the quality objectives) for the project,
- by providing the infrastructure and resources to ensure achievement of project objectives,
- by providing an organizational structure conducive to meeting project objectives,
- by making decisions based on data and factual information,
- by empowering and motivating all project personnel to improve the project processes and product, and
- by planning for future preventive actions.

NOTE The title of the project manager can vary from project to project.

5.2.4 Involvement of people

People at all levels are the essence of an organization and their full involvement enables their abilities to be used for the organization's benefit [see ISO 9000:2000, 0.2c)].

Personnel in the project organization should have well-defined responsibility and authority for their participation in the project. The authority delegated to the project participants should correspond to their assigned responsibility.

Competent personnel should be assigned to the project organization. In order to improve the performance of the project organization, appropriate tools, techniques and methods should be provided to the personnel to enable them to monitor and control the processes.

In the case of multi-national and multi-cultural projects, joint ventures, international projects, etc., the implications of cross-cultural management should be addressed.

5.2.5 Process approach

A desired result is achieved more efficiently when activities and related resources are managed as a process [see ISO 9000:2000, 0.2d)].

The project processes should be identified and documented. The originating organization should communicate the experience gained in developing and using its own processes, or those from its other projects, to the project organization. The project organization should take account of this experience when establishing the project's processes, but it may also need to establish processes that are unique to the project.

This may be accomplished

- by identifying the appropriate processes for the project,
- by identifying the inputs, outputs and the objectives for the project's processes,
- by identifying the process owners and establishing their authority and responsibility,
- by designing the project's processes to anticipate future processes in the life cycle of the project, and
- by defining the interrelations and interactions among the processes.

Process effectiveness and efficiency may be assessed through internal or external review. Assessments can also be made by benchmarking or evaluating the processes against a maturity scale. Maturity scales typically range in degrees of maturity from "no formal system" to "best-in-class". Numerous maturity models have been developed for different applications (see ISO 9004:2000, Annex A).

NOTE The ISO 9000 family of standards provide guidance on a number of process-related and product-related quality management practices. These can assist an organization in meeting its project objectives.

5.2.6 System approach to management

Identifying, understanding and managing interrelated processes as a system contributes to the organization's effectiveness and efficiency in achieving its objectives [see ISO 9000:2000, 0.2e)].

In general, the system approach to management allows for the coordination and compatibility of an organization's planned processes and a clear definition of their interfaces.

A project is carried out as a set of planned, interrelated and interdependent processes. The project organization controls the project processes. To control the project processes, it is necessary to define and link the processes needed, to integrate them and manage them as a system aligned with the originating organization's overall system.

There should be a clear division of responsibility and authority between the project organization and other relevant interested parties (including the originating organization) for the project's processes. These should be determined and recorded.

The project organization should ensure that appropriate communication processes are defined and that information is exchanged between the project's processes as well as between the project, other relevant projects, and the originating organization.

5.2.7 Continual improvement

Continual improvement of the organization's overall performance should be a permanent objective of the organization [see ISO 9000:2000, 0.2f)].

The cycle of continual improvements is based on the "Plan-Do-Check-Act" (PDCA) concept (see Annex B of ISO 9004:2000).

The originating and project organizations are responsible for continually seeking to improve the effectiveness and efficiency of the processes for which they are responsible.

To learn from experience, managing projects should be treated as a process rather than as an isolated task. A system should be put in place to record and analyse the information gained during a project, for use in a continual improvement process.

Provision should be made for self-assessments (see ISO 9004:2000, Annex A), internal audits and, where required, external audits (see ISO 9000:2000, 3.9.1) to identify opportunities for improvement. This should also take account of the time and resources needed.

5.2.8 Factual approach to decision making

Effective decisions are based on the analysis of data and information [see ISO 9000:2000, 0.2g)].

Information about the project's progress and performance should be recorded, for example, in a project log.

Performance and progress evaluations (see 3.4 and 5.3) should be carried out in order to assess the project status. The project organization should analyse the information from performance and progress evaluations to make effective decisions regarding the project and for revising the project management plan.

Information from project closure reports of previous projects should be analysed and used to support the improvement of current or future projects.

5.2.9 Mutually beneficial supplier relationships

An organization and its suppliers are interdependent and a mutually beneficial relationship enhances the ability of both to create value [see ISO 9000:2000, 0.2h)].

The project organization should work with its suppliers when defining its strategies for obtaining external products, especially in the case of product with long lead times. Risk sharing with suppliers may be considered.

Requirements for suppliers' processes and product specifications should be developed jointly by the project organization and its suppliers, in order to benefit from available supplier knowledge. The project organization should also determine a supplier's ability to meet its requirements for processes and products, and should take into account the customer's preferred list of suppliers or selection criteria.

The possibility of a number of projects using a common supplier should be investigated (see ISO 9004:2000, 7.4).

5.3 Management reviews and progress evaluations

5.3.1 Management reviews

The project organization's management should review the project's quality management system, at planned intervals, to ensure its continuing suitability, adequacy, effectiveness and efficiency (see ISO 9004:2000, 5.6). The originating organization may also need to be involved in management reviews.

5.3.2 Progress evaluations

Progress evaluations (see 3.4) should cover all the project's processes and provide an opportunity to assess the achievement of the project objectives. The outputs from progress evaluations can provide significant information on the performance of the project as an input into future management reviews.

a) Progress evaluations should be used

- to assess the adequacy of the project management plan and how the work performed complies with it,
- to evaluate how well the project processes are synchronized and inter-linked,
- to identify and evaluate activities and results that would adversely or favourably affect the achievement of the project objectives,
- to obtain inputs for remaining work in the project,
- to facilitate communication, and
- to drive process improvement in the project, by identifying deviations and changes in risks.

- b) The planning for progress evaluations should include
- the preparation of an overall schedule for progress evaluations (for inclusion in the project management plan),
 - the assignment of responsibility for the management of individual progress evaluations,
 - the specification of the purpose, assessment requirements, processes and outputs for each progress evaluation,
 - the assignment of personnel to participate in the evaluation (e.g. the individuals responsible for the project processes and other interested parties),
 - ensuring that appropriate personnel from the project processes being evaluated are available for questioning, and
 - ensuring that relevant information is prepared and is available for the evaluation (e.g. the project management plan).
- c) Those performing the evaluations should
- understand the purpose of the processes being evaluated, and their effect on the project quality management system,
 - examine relevant process inputs and outputs,
 - review the monitoring and measuring criteria being applied to the processes,
 - determine if the processes are effective,
 - look for potential improvements in process efficiencies, and
 - develop reports, or other relevant outputs, with the progress evaluation results.
- d) Once a progress evaluation has been performed
- the outputs of the evaluation should be assessed against the project's objectives, to determine whether the performance of the project against the planned objectives is acceptable, and
 - responsibility should be assigned for actions resulting from the progress evaluation.

The outputs of progress evaluations can also be used to provide information to the originating organization, for continual improvement of the effectiveness and efficiency of the project management processes.

6 Resource management

6.1 Resource-related processes

6.1.1 General

The resource-related processes aim to plan and control resources. They help to identify any potential problems with resources. Examples of resources include equipment, facilities, finance, information, materials, computer software, personnel, services and space.

The resource-related processes (see Annex A) are

- resource planning, and
- resource control.

NOTE This subclause applies to the quantitative aspects of personnel management. Other aspects such as training are covered in 6.2.

6.1.2 Resource planning

Resources needed for the project should be identified. Resource plans should state what resources will be needed by the project, and when they will be required according to the project schedule. The plans should indicate how, and from where, resources will be obtained and allocated. If applicable, the plans should also include the manner of disposition of excess resources. The plans should be suitable for resource control.

The validity of the inputs to resource planning should be verified. The stability, capability, and performance of organizations supplying resources should be evaluated.

Constraints on resources should be taken into account. Examples of constraints include availability, safety, cultural considerations, international agreements, labour agreements, governmental regulations, funding, and the impact of the project on the environment.

Resource plans, including estimates, allocations and constraints, together with assumptions made, should be documented and included in the project management plan.

6.1.3 Resource control

Reviews should be performed to ensure that sufficient resources are available to meet the project objectives.

The timing of reviews and the frequency of associated data collection and forecasts of resource requirements should be documented in the project management plan.

Deviations from the resource plans should be identified, analysed, acted upon and recorded.

Decisions on actions to be taken should only be made after considering the implications for other project processes and objectives. Changes that affect the project objectives should be agreed with the customer and relevant interested parties before implementation. Changes in resource plans should be authorized as appropriate. Revisions of forecasts of resource requirements should be coordinated with other project processes when developing the plan for remaining work.

Root causes for shortages or excesses in resources should be identified, recorded and used as input for continual improvement.

6.2 Personnel-related processes

6.2.1 General

The quality and success of a project will depend on the participating personnel. Therefore, special attention should be given to the activities in the personnel-related processes.

These processes aim to create an environment in which personnel can contribute effectively and efficiently to the project.

The personnel-related processes (see Annex A) are

- the establishment of the project organizational structure,
- the allocation of personnel, and
- team development.

NOTE The quantitative aspects of personnel management are covered in 6.1. The communication aspects of personnel management are covered in 7.6.

6.2.2 Establishment of the project organizational structure

The project organizational structure should be established in accordance with the requirements and policies of the originating organization and the conditions particular to the project. Previous project experience should be used, when available, for the selection of the most appropriate organizational structure.

The project organizational structure should be designed to encourage effective and efficient communication and cooperation between all participants in the project.

The project manager should ensure that the project organizational structure is appropriate to the project scope, the size of the project team, local conditions and the processes employed. This may result, for example, in a functional or matrix type project organizational structure. The division of authority and responsibility within the project organization structure may also need to take account of the division of authority and responsibility in the originating organization and its organizational structure.

It is necessary to identify and establish the relationships of the project organization

- to the customer and other interested parties,
- to the functions of the originating organization supporting the project (particularly those in charge of monitoring project functions such as schedules, quality and costs), and
- to other relevant projects in the same originating organization.

Job or role descriptions, including assignments of responsibility and authority, should be prepared and documented.

The project function responsible for ensuring that the project's quality management system is established, implemented and maintained should be identified (see ISO 9004:2000, 5.5.2). The interfaces of this function with other project functions, the customer and other interested parties, should be documented.

Reviews of the project organizational structure should be planned and carried out periodically to determine whether it continues to be suitable and adequate.

6.2.3 Allocation of personnel

The necessary competence in terms of education, training, skills and experience should be defined for personnel working on the project (for a definition of "competence", see ISO 9000:2000, 3.9.12).

Personal attributes should be considered in the selection of project personnel. Special attention should be given to the competence requirements of key personnel.

Sufficient time should be allowed for the recruiting of competent personnel, especially when difficulties are anticipated. Selection of personnel should be based on the job or role descriptions, and should take into account their competence and references from previous experience. Selection criteria should be developed and be applied to all levels of personnel being considered for the project. When selecting a project manager, priority should be given to leadership skills.

The project manager should be involved in the selection of personnel for the project positions that are considered essential to the project's success.

The project manager should ensure that a management representative is appointed with responsibility for establishing, implementing and maintaining the project's quality management system (see ISO 9004:2000, 5.5.2).

When assigning members to project teams, their personal interests, personal relationships, strengths and weaknesses should be considered. Knowledge of personal characteristics and experience may help in identifying the best sharing of responsibilities among the members of the project organization.

The job or role description should be understood and accepted by the person assigned. Whenever a member of the project organization is also reporting to a function in the originating organization, the responsibility, authority and reporting lines of that individual should be documented.

The assignment of personnel to specific jobs or roles should be confirmed and communicated to all concerned. The overall performance, including the effectiveness and efficiency of personnel in their job assignments, should be monitored to verify that the assignments are appropriate. Based on results, appropriate actions should be taken such as retraining or recognizing achievement.

Changes of personnel in the project organization should be communicated to the customer and relevant interested parties before implementation, when possible, if the change affects them.

6.2.4 Team development

Effective team performance requires the team members to be individually competent, motivated and willing to cooperate with one another (see ISO 9004:2000, 6.2.1).

To improve team performance, the project team collectively, and the team members individually, should participate in team development activities. Personnel should receive training in, and be made aware of, the relevance and importance of their project activities in the attainment of the project and the quality objectives (see ISO 9004:2000, 6.2.2, and ISO 10015).

Effective teamwork should be recognized and, where appropriate, rewarded.

Managers in the project organization should ensure the establishment of a work environment that encourages excellence, effective working relationships, trust and respect within the team and with all others involved in the project. Consensus-based decision making, structured conflict resolution, clear, open and effective communication and mutual commitment to customer satisfaction should be encouraged and developed (see 5.2.3 for a discussion of "leadership").

Wherever possible, personnel affected by changes in the project or in the project organization should be involved in planning and implementing the change.

7 Product realization

7.1 General

This clause covers the seven project management process groupings necessary to produce the project's product (see 4.1.3).

7.2 Interdependency-related processes

7.2.1 General

Projects consist of a system of planned and interdependent processes and an action in one of these usually affects others. The overall management of the planned interdependencies among the project processes is the responsibility of the project manager. The project organization should also manage effective and efficient communication between different groups of personnel involved in the project and establish clear assignment of their responsibility.

The interdependency-related processes (see Annex A) are

- project initiation and project management plan development,
- interaction management,

- change management, and
- process and project closure.

7.2.2 Project initiation and project management plan development

It is essential that a project management plan, which should include or reference the project's quality plan, be established and be kept up to date. The degree of detail included may depend on factors such as the size and the complexity of the project.

During project initiation, details of relevant past projects from the originating organization should be identified and communicated to the project organization. This will enable the best use to be made of the experience gained (e.g. lessons learned) from these previous projects.

If the purpose of a project is to fulfil the requirements of a contract, contract reviews should be performed during the development of the project management plan to ensure that the contract requirements can be met (see ISO 9004:2000, 7.2). Where the project is not the result of a contract, an initial review should be undertaken to establish the requirements, and confirm that they are appropriate and achievable.

The project management plan should:

- a) refer to the customer's and other relevant interested parties' documented requirements and the project objectives; the input source for each requirement should also be documented to allow traceability;
- b) identify and document the project processes and their purposes;
- c) identify organizational interfaces, giving particular attention to
 - the project organization's connection and reporting lines with the various functions of the originating organization, and
 - interfaces between functions within the project organization;
- d) integrate plans resulting from the planning carried out in other project processes; these plans include
 - the quality plan,
 - work breakdown structure (see 7.3.4),
 - project schedule (see 7.4.5),
 - project budget (see 7.5.3),
 - communication plan (see 7.6.2),
 - risk management plan (see 7.7.2), and
 - purchasing plan (see 7.8.2);all plans should be reviewed for consistency and any discrepancies resolved;
- e) identify, include or reference the product characteristics and how they should be measured and assessed;
- f) provide a baseline for progress measurement and control, to provide for planning of the remaining work; plans for reviews and progress evaluations should be prepared and scheduled;

- g) define performance indicators and how to measure them, and make provision for regular assessment in order to monitor progress; these assessments should
 - facilitate preventive and corrective actions, and
 - confirm that the project objectives remain valid in a changing project environment;
- h) provide for reviews of the project required by the contract to ensure the fulfilment of the requirements of the contract;
- i) be reviewed regularly, and also when significant changes occur.

The project quality management system should be documented or referenced in the project's quality plan. Linkage should be established between the project's quality plan and applicable parts of the quality management system of the originating organization. As far as is practicable, the project organization should adopt and, if necessary, adapt the quality management system and procedures of the originating organization. In cases where specific requirements for the quality management system from other relevant interested parties exist, it should be ensured that the project's quality management system is compatible with these requirements.

Quality management practices, such as documentation, verification, traceability, reviews and audits should be established throughout the project.

7.2.3 Interaction management

To facilitate the interdependencies (which are planned) between processes, the interactions (which are not planned) in the project need to be managed. This should include the following:

- establishing procedures for interface management;
- holding project inter-functional meetings;
- resolving issues such as conflicting responsibilities or changes to risk exposure;
- measuring project performance using such techniques as earned value analysis (a technique for monitoring overall project performance against a budget baseline);
- carrying out progress evaluations to assess project status and to plan for the remaining work.

The progress evaluations should also be used to identify potential interface problems. It should be noted that risk is usually high at the interfaces.

NOTE Project communication is an essential factor in project coordination and is discussed in 7.6.

7.2.4 Change management

Change management covers the identification, evaluation, authorization, documentation, implementation and control of change. Before a change is authorized, the intent, extent and impact of the change should be analysed. Those changes that affect the project objectives should be agreed with the customer and other relevant interested parties.

Change management should also take the following into account:

- managing changes to the project scope, project objectives, and to the project management plan;
- coordinating changes across inter-linked project processes and resolving any conflicts;
- procedures for documenting change;

- continual improvement (see Clause 8);
- aspects of change affecting personnel (see 6.2.4).

Changes may result in negative impacts (e.g. claims) on the project and should be identified as soon as possible. The root causes of negative impacts should be analysed and the results used to produce prevention-based solutions and implement improvements in the project process.

An aspect of change management is configuration management. For the management of projects, it is taken to refer to the configuration of the project's product(s). This may include both non-deliverable items (such as test tools and other installed equipment) and deliverable items.

NOTE For further guidance on configuration management, see ISO 10007.

7.2.5 Process and project closure

The project itself is a process and special attention should be given to its closure.

The closure of processes and the project should be defined during the initiation stage of the project and be included in the project management plan. When planning the closure of processes and projects, the experience gained from the closure of previous processes and projects (see Clause 8) should be taken into account.

At any time during the life cycle of a project, completed processes should be closed as planned. When a process is closed, it should be ensured that all records are compiled, distributed within the project and to the originating organization, as appropriate, and retained for a specified time.

The project should be closed as planned. However, in certain cases it may be necessary to close the project earlier or later than planned, due to unpredicted events.

Whatever the reason for project closure, a complete review of project performance should be undertaken. This should take into account all relevant records, including those from progress evaluations and inputs from interested parties. Special consideration should be given to feedback from the customer and other relevant interested parties. This feedback should be measurable where possible.

Based on this review, appropriate reports should be prepared, highlighting experience that can be used by other projects and for continual improvement (see 8.3).

At the closure of the project, there should be a formal handover of the project product to the customer. Project closure is not completed until the customer formally accepts the project product.

The closure of the project should be communicated to other relevant interested parties.

7.3 Scope-related processes

7.3.1 General

The project's scope includes a description of the project's product, its characteristics and how they are to be measured or assessed.

- a) The scope-related processes aim
- to translate the customers' and other interested parties' needs and expectations into activities to be carried out to achieve the objectives of the project, and to organize these activities,
 - to ensure that personnel work within the scope during the realization of these activities, and
 - to ensure that the activities carried out in the project meet the requirements described in the scope.

- b) The scope-related processes (see Annex A) are
- concept development,
 - scope development and control,
 - definition of activities, and
 - control of activities.

7.3.2 Concept development

Customer needs and expectations for product and processes, both stated and generally implied, should be translated into documented requirements, including statutory and regulatory aspects which, when required by the customer, should be mutually agreed.

Other interested parties should be identified and their needs established. These should be translated into documented requirements and, where relevant, agreed to by the customer.

7.3.3 Scope development and control

When developing the project scope, the characteristics of the project's product should be identified and documented in measurable terms and as completely as is possible. These characteristics should be used as the basis for design and development. It should be specified how these characteristics will be measured or how their conformity to the customers' and other interested parties' requirements will be assessed. Product and process characteristics should be traceable to the documented requirements of the customer and other interested parties.

When alternative approaches and solutions are considered during scope development, supporting evidence (including the analyses performed and other considerations used) should be documented and referenced in the scope.

NOTE How to manage changes to the scope is dealt with in the change management process (see 7.2.4).

7.3.4 Definition of activities

The project should be systematically structured into manageable activities to meet customer requirements for product and processes.

NOTE Frequently, the term "breakdown structure" is used to describe the way in which a project may be divided by level into discrete groups for programming, cost planning and control purposes. Also, terms such as "activities", "tasks" and "work packages" are used for the elements of this structuring, and the result is usually known as a "work breakdown structure" (WBS). For the purposes of this International Standard, the term "activity" is used as the generic term for an item of work (see 3.1).

Personnel assigned to the project should participate in the definition of these activities. This will enable the project organization to benefit from their experience, and to gain their understanding, acceptance and ownership.

Each activity should be defined in such a way that its results are measurable. The list of activities should be checked for completeness. The activities defined should include quality management practices, progress evaluations, and the preparation and maintenance of a project management plan.

The interactions between activities in a project that could potentially cause problems between the project organization and the interested parties, should be identified and documented.

7.3.5 Control of activities

The activities within the project should be carried out and controlled in accordance with the project management plan. Process control includes control of the interactions between activities to minimize conflicts or misunderstandings. In processes involving new technologies, particular attention should be given to their control.

Activities should be reviewed and evaluated to identify potential deficiencies and opportunities for improvement. The timing of reviews should be adapted to the complexity of the project.

The results of reviews should be used for progress evaluations to assess process outputs and to plan for the remaining work. The revised plan for the remaining work should be documented.

7.4 Time-related processes

7.4.1 General

The time-related processes aim to determine dependencies and the duration of activities and to ensure timely completion of the project.

The time-related processes (see Annex A) are

- planning of activity dependencies,
- estimation of duration,
- schedule development, and
- schedule control.

7.4.2 Planning of activity dependencies

The interdependencies among the activities in a project should be identified and reviewed for consistency. Any need for changing the data from the activity identification process should be justified and documented.

Whenever possible, during development of the project plan, standard or proven project network diagrams should be used to take advantage of previous experience. Their appropriateness to the project should be verified.

7.4.3 Estimation of duration

Estimates of the duration of activities should be established by personnel with responsibility for those activities. Duration estimates from past experience should be verified for accuracy and applicability to present project conditions. The inputs should be documented and traceable to their origins. When collecting duration estimates, it is useful to obtain associated resource estimates at the same time as an input to resource planning (see 6.1.2).

When duration estimation involves significant uncertainty, the risks should be evaluated, documented and mitigated. Allowance for remaining risks should be incorporated into the estimates.

When required or appropriate, the customer or other interested parties should be involved in duration estimation.

7.4.4 Schedule development

Input data for schedule development should be identified and checked for conformity to specific project conditions. Activities with long lead times or long durations should be taken into account when determining the critical path. The critical path (the longest duration path through the network) activities require explicit identification.

Standardized schedule formats, suitable for the different user needs, should be implemented.

The relationships of duration estimates to activity dependencies should be checked for consistency. Any inconsistencies found should be resolved before schedules are finalized and issued. The schedules should identify critical and near-critical activities.

The schedule should identify events that require specific inputs or decisions, or ones at which major outputs are planned. These are sometimes referred to as “key events” or “milestones”. Progress evaluations should be included in the schedule.

The customer and other interested parties should be kept informed during the development of the schedule and be involved in the development of the schedule when required. External inputs (e.g. customer-dependent inputs expected during the project) should be analysed and taken into account in the schedule.

Appropriate schedules should be supplied to the customer and other interested parties for information or, if required, for approval.

7.4.5 Schedule control

The project organization should carry out regular reviews of the project schedule, as defined in the project management plan. To ensure adequate control over project activities, processes and related information, the timing of schedule reviews and the frequency of data collection should be established.

Project progress should be analysed in order to identify trends and possible uncertainties in the work remaining in the project. (See 7.7 for a description of “uncertainties”.) Up-to-date schedules should be used in progress evaluations and meetings. Deviations from the schedule should be identified, analysed and, if significant, acted upon.

Root causes for variances from schedule, both favourable and unfavourable, should be identified. Action should be taken to ensure that unfavourable variances do not affect project objectives. Causes of both favourable and unfavourable variances should be used to provide data as a basis for continual improvement (see Clause 8).

Possible impacts of schedule changes on the budget and resources of the project and on the quality of the product should be determined. Decisions on actions to be taken should only be made based on facts after taking into account their implications for other project processes and objectives. Changes that affect the project objectives should be agreed with the customer and relevant interested parties before implementation.

When action is required to take account of variances, the personnel involved and their roles should be identified. Revisions of the schedule should be coordinated with other project processes when developing the plan for the remaining work.

External inputs (e.g. customer-dependent inputs expected during the project) should be monitored. The customer and other interested parties should be kept informed of any proposed changes to the schedule and should be involved in making decisions that affect them.

7.5 Cost-related processes

7.5.1 General

The cost-related processes aim to forecast and manage the project costs. This should ensure that the project is completed within budget constraints, and that cost information can be provided to the originating organization.

The cost-related processes (see Annex A) are

- cost estimation,
- budgeting, and
- cost control.

NOTE For further guidance on the economic effects of quality management, see ISO/TR 10014.

7.5.2 Cost estimation

All project costs should be clearly identified (e.g. cost of activities, overheads, goods and services). Cost estimation should consider relevant sources of information and should be linked to the project's breakdown structures (see 7.3.4). Cost estimates from past experience should be verified for accuracy and applicability to present project conditions. The costs should be documented and traceable to their origins.

Particular attention should be given to budgeting sufficient funds for the establishment, implementation and maintenance of the project quality management system.

Cost estimation should take into account present and forecast trends in the economic environment (e.g. inflation, taxation and exchange rates).

When cost estimation involves significant uncertainties, these uncertainties should be identified, evaluated, documented and acted upon (see 7.7.2). Allowance for remaining uncertainties, sometimes called contingencies, should be incorporated in the estimates.

The cost estimates should be in a form that enables budgets to be established and developed in accordance with approved accounting procedures as well as project organization needs.

7.5.3 Budgeting

The project budget should be based on the cost estimates and schedules with a defined procedure for its acceptance.

The budget should be consistent with the project objectives and any assumptions, uncertainties and contingencies should be identified and documented. The budget should include all authorized costs and should be in a form suitable for project cost control.

7.5.4 Cost control

Prior to any expenditure, a cost control system and associated procedures should be established, documented and communicated to those responsible for authorizing work or expenditure.

The timing of reviews and the frequency of data collection and forecasts should be established. This ensures adequate control over project activities and related information. The project organization should verify that the remaining work can be carried out to completion within the remaining budget. Any deviation from the budget should be identified and, if exceeding defined limits, the variance should be analysed and acted upon.

Project cost trends should be analysed, using techniques such as "earned value analysis". The plan for the remaining work should be reviewed to identify uncertainties.

Root causes for variances to budget, both favourable and unfavourable, should be identified. Action should be taken to ensure that unfavourable variances do not affect project objectives. Causes of both favourable and unfavourable variances should be used to provide data as a basis for continual improvement (see Clause 8).

Decisions on actions to be taken should only be made based on facts, after taking into account the implications for other project processes and objectives. Changes in the cost of the project should be appropriately approved and authorized prior to expenditure. Revisions of the budget forecast should be coordinated with other project processes when developing the plan for remaining work.

The information needed to ensure the timely release of funds should be made available and provided as input to the resource control process.

The project organization should carry out regular reviews of the project costs, as defined in the project management plan, and take into account any other financial reviews (e.g. external reviews by relevant interested parties).

7.6 Communication-related processes

7.6.1 General

The communication-related processes aim to facilitate the exchange of information necessary for the project.

They ensure timely and appropriate generation, collection, dissemination, storage and ultimate disposition of project information.

The communication-related processes (see Annex A) are

- communication planning,
- information management, and
- communication control.

NOTE Further information is available in ISO 9004:2000, 5.5.3 (internal communication) and 7.2 (processes related to interested parties).

7.6.2 Communication planning

The originating and project organizations should ensure that appropriate communication processes are established for the project, and that communication takes place regarding the effectiveness and efficiency of the quality management system.

Communication planning should take into account the needs of the originating organization, project organization, customers and other interested parties, and should result in a documented communication plan.

This communication plan should define the information that will be formally communicated, the media used to transmit it and the frequency of communication. The requirements for the purpose, frequency, timing and records of meetings should be defined in the communication plan.

The format, language and structure of project documents and records should be planned to ensure compatibility. The communication plan should define the information management system (see 7.6.3), identify who will send and receive information, and should reference the relevant document control, record control and security procedures. The format for progress evaluation reports should be designed to highlight deviations from the project management plan.

NOTE For additional guidance on the control of documents and records, see ISO 9004:2000, 4.2.

7.6.3 Information management

The project organization should identify its information needs and should establish a documented information management system.

The project organization should also identify internal and external sources of information. The way in which information is managed should take into consideration the needs of both the project and originating organizations.

In order to manage the project's information, procedures defining the controls for information preparation, collection, identification, classification, updating, distribution, filing, storage, protection, retrieval, retention time and disposition should be established.

Recorded information should indicate conditions prevailing at the time the activity was recorded. This will allow the validity and relevance of the information to be verified before use in other projects.

The project organization should ensure appropriate security of information, taking into account confidentiality, availability and integrity of information.

Information should be relevant to the needs of the recipients, and should be clearly presented and distributed with strict adherence to time schedules.

All agreements, including informal ones, affecting the project performance should be formally documented.

Rules and guidelines for meetings should be established and should be appropriate to the type of meeting.

Meeting agenda should be distributed in advance and should identify for each item the personnel whose attendance is required.

Minutes of meetings should include details of the decisions made, the outstanding issues and the agreed actions (including due dates and the personnel assigned to carry them out). The minutes should be distributed to relevant interested parties within an agreed time.

The project organization should use the data, information and knowledge to set and meet its objectives. The managers of the project organization and originating organization should evaluate the benefits derived from the use of the information in order to improve the management of information (see Clause 8).

NOTE An information management system need only be as complex as the project requires.

7.6.4 Communication control

The communication system should be planned and implemented. It should be controlled, monitored and reviewed to ensure that it continues to meet the needs of the project. Particular attention should be given to interfaces between functions and organizations where misunderstandings and conflicts may occur.

7.7 Risk-related processes

7.7.1 General

Commonly "risk" has only been considered as a negative aspect. "Uncertainty", which is a more modern concept, has always included both negative and positive aspects. Positive aspects are usually referred to as "opportunities".

The term "risk" is used in this International Standard in the same sense as "uncertainty", i.e. having both negative and positive aspects.

The management of project risks deals with uncertainties throughout the project. This requires a structured approach that should be documented in a risk management plan. The risk-related processes aim to minimize the impact of potential negative events and to take full advantage of opportunities for improvement.

Uncertainties are also related either to the project processes or to the project's product.

The risk-related processes (see Annex A) are

- risk identification,
- risk assessment,
- risk treatment, and
- risk control.

7.7.2 Risk identification

Risk identification should be performed at the initiation of the project, at progress evaluations and other occasions when significant decisions are made. Experience and historical data from previous projects maintained by the originating organization (see 8.3.1) should be used for this purpose. The output of this process should be recorded in a risk management plan, which should be incorporated or referenced in the project management plan.

Potential risks arising from activity-, process- and product-related interactions between the project organization, the originating organization and interested parties should be identified and recorded.

Risk identification should consider not only risks in cost, time and product, but also risks in areas such as product quality, security, dependability, professional liability, information technology, safety, health and environment. This identification should take into account any applicable current and anticipated statutory or regulatory requirements. The interactions between different risks should be considered. The risks resulting from new technologies and developments should also be identified.

Any identified risk with significant impact should be documented and a person should be assigned with the responsibility, authority and resources for managing that risk.

7.7.3 Risk assessment

Risk assessment is the process of analysing and evaluating identified risks to the project processes and to the project's product.

All identified risks should be assessed. In this assessment, experience and historical data from previous projects should be taken into account.

The criteria and techniques to be used in the assessment should be evaluated. A qualitative analysis should be made and a quantitative analysis should follow wherever possible.

NOTE There are various qualitative and quantitative methods of risk assessment available for performing such analyses. These are generally based on assessing the probability of occurrence and the impact of identified risks.

Levels of risk acceptable for the project, and the means to determine when agreed-to levels of risk are exceeded, should be identified.

The results of all analyses and evaluations should be recorded and communicated to relevant personnel.

7.7.4 Risk treatment

Solutions to eliminate, mitigate, transfer, share or accept risks, and plans to take advantage of opportunities should preferably be based on known technologies or data from past experience. Consciously accepted risks should be identified and the reasons for accepting them recorded.

When a solution to an identified risk is proposed, it should be verified that there will be no undesirable effects or new risks introduced by its implementation, and that the resulting residual risk is addressed.

When contingencies to manage risks are made in the time schedule or in the budget, they should be identified and maintained separately.

Special attention should be given to developing solutions for potential risks arising from activity-, process- and product-related interactions between the project organization, the originating organization and interested parties.

7.7.5 Risk control

Throughout the project, risks should be monitored and controlled by an iterative process of risk identification, risk assessment and risk treatment.

The project should be managed by taking into account that there are always risks. Personnel should be encouraged to anticipate and identify risks and report them to the project organization.

Risk management plans should be maintained ready for use.

Reports on project risk monitoring should be part of progress evaluations.

7.8 Purchasing-related processes

7.8.1 General

The purchasing-related processes deal with obtaining products for the project.

The purchasing-related processes are

- purchasing planning and control,
- documentation of purchasing requirements,
- supplier evaluation,
- subcontracting, and
- contract control.

NOTE 1 The terms “purchase”, “acquisition” or “procurement” are also often used in this context.

NOTE 2 As noted in ISO 9000:2000, 3.4.2, the term “product” refers to both tangible and intangible product.

NOTE 3 Guidance on purchasing products, in addition to that given below, can be found in ISO 9004:2000, 7.4.

For the purposes of this International Standard, and for reference to ISO 9004:2000, in this clause the “organization” is the “project organization”, and “suppliers” supply products to the project organization.

7.8.2 Purchasing planning and control

A purchasing plan should be prepared in which the products to be obtained are identified and scheduled, taking note of product requirements including specification, time and cost.

All products that are input to the project should be subjected to the same levels of purchasing controls, regardless of whether they are obtained from external suppliers or from the originating organization (i.e. “in-house”). External products are normally obtained by contract. “In-house” products can be obtained using internal acquisition procedures and controls. For “in-house” products, some of the purchasing controls described below may be simplified.

Purchasing should be planned so that the interfaces and interactions with suppliers can be managed by the project organization.

Adequate time should be allocated to complete the activities in the purchasing-related processes. Previous experience of supplier performance should be used to plan for potential problems, such as the delivery of items with long delivery times.

To provide adequate purchasing control, the project organization should carry out regular reviews of the purchasing progress, which should be compared to the purchasing plan and action taken if needed. The results of the reviews should be input into progress evaluations.

7.8.3 Documentation of purchasing requirements

Purchasing documents should identify the product, its characteristics, appropriate quality management system requirements, and associated documentation. They should also include purchasing responsibility, cost and delivery dates for the product, requirements for auditing (when necessary), and right of access to supplier premises. It should be ensured that customer requirements are taken into account in the purchasing documents.

Tendering documents (e.g. “Requests for Quotation”) should be structured to facilitate comparable and complete responses from potential suppliers.

Purchasing documents should be reviewed before distribution, to verify that all product-related requirements, and other aspects (such as purchasing responsibility) are completely specified.

NOTE For further information, see ISO 9004:2000, 7.4.1.

7.8.4 Supplier evaluation

Suppliers to the project should be evaluated. An evaluation should consider all the aspects of a supplier that may impact on the project, such as technical experience, production capability, delivery times, quality management system and financial stability.

A register of approved suppliers should be maintained by the project organization. A register may also be maintained by the originating organization and be communicated to the project organization, where applicable.

NOTE For further guidance on supplier evaluation, see ISO 9004:2000, 7.4.2 and 8.4

7.8.5 Contracting

There should be a process for the project organization to contract with suppliers to the project. It should include communication of the projects' quality management system requirements and, where applicable, the quality policy and quality objectives to the supplier.

In tender evaluations, all deviations from the specification in a supplier proposal should be identified and taken into account in the evaluation. Deviations from the specification, and recommendations for improvement, should be approved by the same functions that carried out the original review and approval of the specification.

Cost evaluation of tenders should be based not only on the price from suppliers, but also on other associated costs such as cost of operation, maintenance, license fees, transport, insurance, customs duty, exchange rate variation, inspection, audits and resolution of deviations.

The contract documents should be reviewed to ensure that they include the results of any pre-contract negotiation with the supplier.

Before contracting for the supply of product, the supplier's quality management system should be evaluated.

7.8.6 Contract control

Contract control starts at the placing of the contract, or at the time of an agreement in principle to award the contract, such as a letter of intent. A system should be implemented to ensure that the contract conditions, including due dates and records, are met.

Contract control should include the establishment of appropriate contractual relationships and the integration of the outputs from these relationships into the overall management of the project.

Supplier performance should be monitored to ensure that it meets contract conditions. The results of monitoring should be fed back to suppliers and any actions agreed.

Prior to contract closure, it should be verified that all contract conditions have been met and that feedback on supplier performance has been obtained to update the register of approved suppliers.

8 Measurement, analysis and improvement

8.1 Improvement-related processes

This clause provides guidance on how the originating organization and project organization should learn from projects.

Both should use the results of measurement and of the analysis of data from the project processes and apply corrective action, preventive action and loss prevention methods (see ISO 9004:2000, 8.5) to enable continual improvement in both current and future projects.

The improvement-related processes are

- measurement and analysis, and
- corrective action, preventive action and loss prevention.

8.2 Measurement and analysis

The originating organization needs to ensure that measurement, collection and validation of data are effective and efficient, to improve the organization's performance and enhance the satisfaction of the customer and other interested parties.

Examples of measurement of performance include

- the evaluation of individual activities and processes,
- auditing,
- evaluations of actual resources used, together with cost and time, compared to the original estimates,
- product evaluations,
- the evaluation of supplier performance,
- the achievement of project objectives, and
- the satisfaction of customers and other interested parties.

NOTE For further information, see ISO 9004:2000, Clause 8.

The project organization's management should ensure that records of nonconformities and the disposition of the nonconformities, in the project's product and processes, are analysed to assist learning and to provide data for improvement. The project organization, in conjunction with the customer, should decide which nonconformities should be recorded and which corrective actions controlled.

8.3 Continual improvement

8.3.1 Continual improvement by the originating organization

The originating organization should define the information it needs to learn from projects and should establish a system for identifying, collecting, storing, updating and retrieving information from projects.

The originating organization should ensure that the information management system for its projects is designed to identify and collect relevant information from the projects, in order to improve the project management processes.

The originating organization should maintain a list of all significant risks identified by its projects.

The originating organization should ensure that relevant information is used by other projects that it originates.

The relevant information needed to learn from projects is derived from information contained within the project, including feedback from customers and other interested parties. Information is also derived from other sources such as project logs, appropriate closure reports, claims, audit results, analysis of data, corrective and

preventive actions, and project reviews. Before using this information, its validity should be verified by the originating organization.

Just prior to closing the project, the originating organization should carry out documented reviews of project performance, highlighting experience from the project that can be used by other projects. The project management plan should be used as the framework for conducting the review. If possible, these reviews should involve the customers and other relevant interested parties.

NOTE For long-term projects, interim reviews should be considered to collect information more effectively, and allow for timely improvements.

8.3.2 Continual improvement by the project organization

The project organization should design the project's information management system to implement the requirements specified for learning from the project by the originating organization.

The project organization should ensure that the information it provides to the originating organization is accurate and complete.

The project organization should implement improvements using information relevant to the project derived from the above-mentioned system, established by the originating organization.

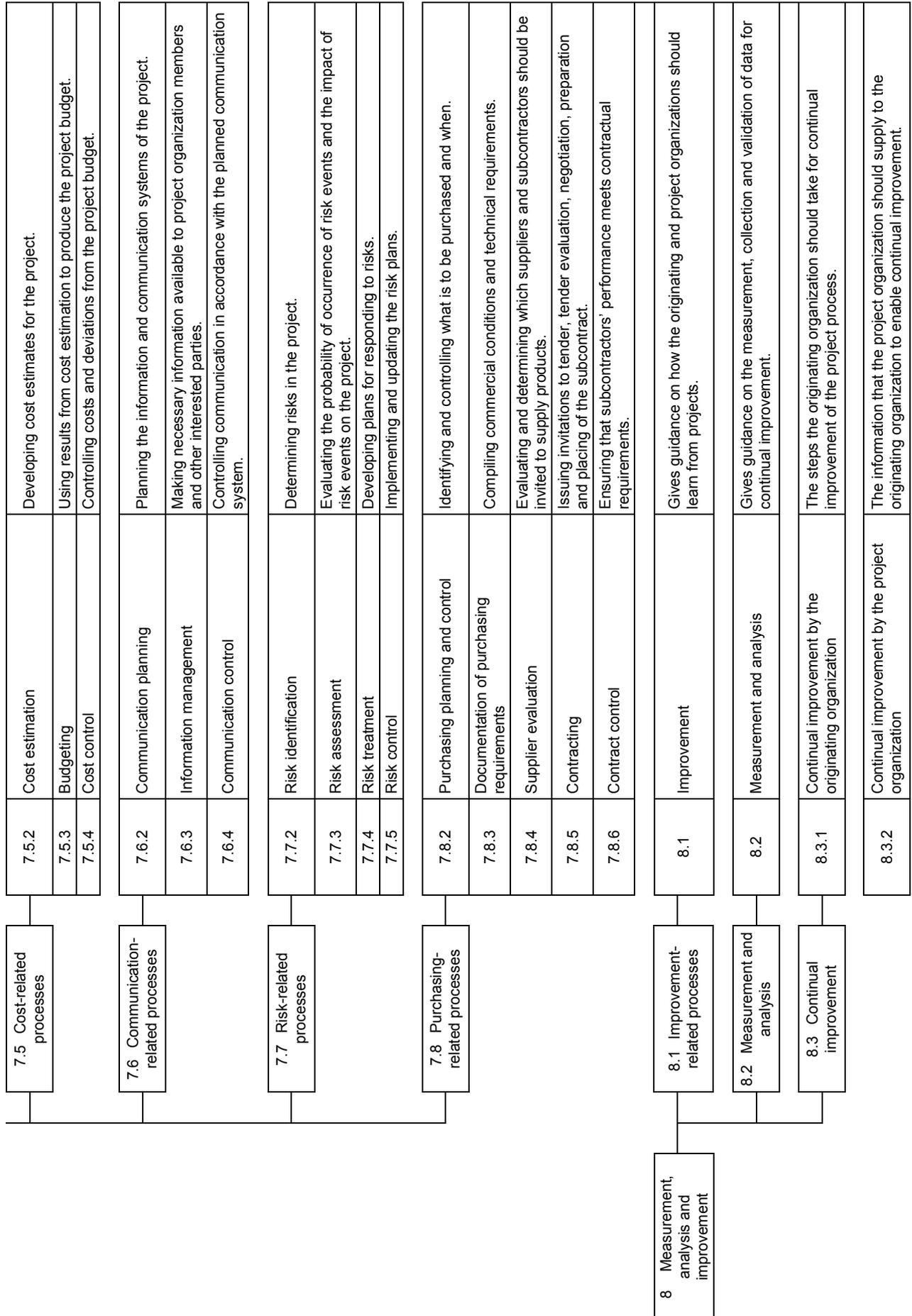
NOTE For further guidance, see ISO 9004:2000, 8.5.

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Annex A
(informative)

Flowchart of processes in projects

| Clause | Subclause | Sub-subclause | Process | Process description |
|---------------------------------|---------------------------------------|-----------------------------|---|---|
| 5 Management responsibility | 5.2 Strategic process | 5.2 | Strategic | A direction-setting process which includes planning the establishment and implementation of the quality management system based on the application of the quality management principle. |
| | | 6 Resource management | 6.1 Resource-related processes | 6.1.2 |
| 6.1.3 | Resource control | | | Comparing actual usage against resource plans and taking action if needed. |
| 6.2 Personnel-related processes | 6.2.2 | | Establishment of project organizational structure | Defining a project organizational structure tailored to suit the project needs, including identifying roles in the project and defining authority and responsibility. |
| | 6.2.3 | Allocation of personnel | Selecting and assigning sufficient personnel with appropriate competence to suit the project needs. | |
| | 6.2.4 | Team development | Developing individual and team skills and ability to enhance project performance. | |
| 7 Product realization | 7.2 Interdependency-related processes | 7.2.2 | Project initiation and project management plan development | Evaluating customers' and other interested parties' requirements, preparing a project management plan and initiating other processes. |
| | | 7.2.3 | Interaction management | Managing interactions during the project. |
| | | 7.2.4 | Change management | Anticipating change and managing it across all processes. |
| | | 7.2.5 | Process and project closure | Closing processes and obtaining feedback. |
| | | 7.3 Scope-related processes | 7.3.2 | Concept development |
| | 7.3.3 | | Scope development and control | Documenting the characteristics of the project product in measurable terms and controlling them. |
| | 7.3.4 | | Definition of activities | Identifying and documenting activities and steps required to achieve the project objectives. |
| | 7.3.5 | | Control of activities | Controlling the actual work carried out in the project. |
| | 7.4 Time-related processes | | 7.4.2 | Planning of activity dependencies |
| | | 7.4.3 | Estimation of duration | Estimating the duration of each activity in connection with the specific conditions and the resources required. |
| | | 7.4.4 | Schedule development | Interrelating the project time objectives, activity dependencies and their durations as the framework for developing general and detailed schedules. |
| | | 7.4.5 | Schedule control | Controlling the realization of the project activities, for confirming the proposed schedule or for taking adequate actions for recovering from delays. |



Bibliography

- [1] ISO 9001:2000, *Quality management systems — Requirements*
- [2] ISO 10005:1995, *Quality management — Guidelines for quality plans*
- [3] ISO 10007:2003, *Quality management systems — Guidelines for configuration management*
- [4] ISO/TR 10013:2001, *Guidelines for quality management system documentation*
- [5] ISO/TR 10014:1998, *Guidelines for managing the economics of quality*
- [6] ISO 10015:1999, *Quality management — Guidelines for training*
- [7] ISO/TR 10017:2003, *Guidance on statistical techniques for ISO 9001:2000*
- [8] ISO 19011:2002, *Guidelines for quality and/or environmental management systems auditing*
- [9] ISO/IEC 12207:1995, *Information technology — Software life cycle processes*
- [10] ISO/IEC 17000¹⁾, *Conformity assessment — General vocabulary*
- [11] ISO/IEC Guide 73:2002, *Risk management — Vocabulary — Guidelines for use in standards*
- [12] IEC 60300-3-3:1996, *Dependability management — Part 3: Application guide — Section 3: Life cycle costing*
- [13] IEC 60300-3-9:1995, *Dependability management — Part 3: Application guide — Section 9: Risk analysis of technological systems*
- [14] IEC 62198:2001, *Project risk management — Application guidelines*

1) To be published.

