TECHNICAL REPORT

ISO/IEC TR 24748-2

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Systems and software engineering — Life cycle management —

Part 2: Guide to the application of ISO/IEC 15288 (System life cycle processes)

Ingénierie des systèmes et du logiciel — Gestion du cycle de vie — Partie 2: Guide pour l'application de l'ISO/CEI 15288 (Processus du cycle de vie du système)

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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.

In exceptional circumstances, when the joint technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide to publish a Technical Report. A Technical Report is entirely informative in nature and shall be subject to review every five years in the same manner as an International Standard.

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/IEC TR 24748-2 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*.

This first edition of ISO/IEC TR 24748-2 cancels and replaces ISO/IEC TR 19760:2003, which has been technically revised.

ISO/IEC TR 24748 consists of the following parts, under the general title *Systems and software engineering — Life cycle management*:

— *Part 1: Guide for life cycle management*

— *Part 2: Guide to the application of ISO/IEC 15288 (System life cycle processes)*

— *Part 3: Guide to the application of ISO/IEC 12207 (Software life cycle processes)*

Introduction

ISO/IEC 12207:1995 (*Information technology — Software life cycle processes*) and ISO/IEC 15288:2002 (*Systems engineering — System life cycle processes*) have application guides (ISO/IEC TR 15271:1998 and ISO/IEC 19760:2003, respectively) for the use of each International Standard individually. However, both International Standards were re-published in 2008 after significant revisions to align their terminology and structure. As a consequence, the two published application guides no longer relate to their respective standards and can not provide the guidance intended.

ISO/IEC TR 24748-1 (*Systems and software engineering — Life cycle management — Part 1: Guide for life cycle management*) was published in 2010 to facilitate the joint usage of the process content of ISO/IEC 15288:2008 and ISO/IEC 12207:2008 by providing unified and consolidated guidance on life cycle management of systems and software. This helps ensure consistency in system concepts and life cycle concepts, models, stages, processes, process application, key points of view, adaptation and use in various domains as the two standards are used in combination. That in turn helps a project design a life cycle model for managing the progress of its project. ISO/IEC TR 24748-1 also aids in identifying and planning use of life cycle processes described in ISO/IEC 15288 and ISO/IEC 12207 that enable the product or service project to be completed successfully, meeting its objectives/requirements for each stage and for the overall project.

This part of ISO/IEC TR 24748 supports use of ISO/IEC 15288:2008 and replaces ISO/IEC TR 19760. This part of ISO/IEC TR 24748 and its companion, ISO/IEC TR 24748-3 (*Guide to the application of ISO/IEC 12207*) — which replaces ISO/IEC TR 15271 — continue and make use of the alignment effort evident in the two revised International Standards. Both terminology and structure in the guides are identical wherever possible and content is aligned consistent with that in the two International Standards. Consequently, the users of ISO/IEC 12207:2008 and ISO/IEC 15288:2008 will benefit from having documents complementarily addressing all aspects of products or services over their life cycle.

Besides the above, there is also increasing recognition of the importance of ensuring that all life cycle stages, and all aspects within each stage, are supported with thorough guidance enabling alignment with any process documents subsequently created that focus on areas besides systems and software. This could include hardware, humans, processes (e.g. review process), procedures (e.g. operator instructions), facilities and naturally occurring entities (e.g. water, organisms, minerals). The concept and structure of the ISO/IEC TR 24748 series of Technical Reports is intended to allow its extension to such additional domains where that will provide value to users.

Systems and software engineering — Life cycle management —

Part 2: Guide to the application of ISO/IEC 15288 (System life cycle processes)

1 Scope

This part of ISO/IEC TR 24748 is a guide for the application of ISO/IEC 15288:2008. It addresses system, life cycle, process, organizational, project, and adaptation concepts, principally through reference to ISO/IEC TR 24748-1 and ISO/IEC 15288:2008. It then gives guidance on applying ISO/IEC 15288:2008 from the aspects of strategy, planning, application in organizations, and application on projects.

This part of ISO/IEC TR 24748 is intentionally aligned with both ISO/IEC TR 24748-1 and ISO/IEC TR 24748-3 (*Guide to the application of ISO/IEC 12207*) in its terminology, structure and content.

2 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 12207:2008, ISO/IEC 15288:2008 and ISO/IEC TR 24748-1:2010, apply.

3 Overview of ISO/IEC 15288:2008

3.1 General

ISO/IEC 15288:2008, Systems and software engineering – System life cycle processes, establishes a common framework for system life cycle processes, with well-defined terminology, that can be referenced by the systems engineering industry. It applies to the acquisition of systems, which can be comprised of products, services, or both, as well as to the supply, development, operation, maintenance, and disposal of systems, whether performed internally or externally to an organization.

ISO/IEC 15288:2008 may be used stand alone or jointly with other International Standards, such as ISO/IEC 12207, and supplies a process reference model that supports process capability assessment in accordance with ISO/IEC 15504-2 (Process assessment).

The purpose of ISO/IEC 15288:2008 is to provide a defined set of processes to facilitate communication among acquirers, suppliers and other stakeholders in the life cycle of a system. ISO/IEC 15288:2008 is written for acquirers of systems and for suppliers, developers, operators, maintainers, managers, quality assurance managers, and users of systems.

3.2 Structure of ISO/IEC 15288:2008

ISO/IEC 15288:2008 contains requirements in two Clauses:

— Clause 6, which defines the requirements for the system life cycle processes,

— Annex A that provides requirements for tailoring of ISO/IEC 15288:2008.

Five informative annexes support the use of ISO/IEC 15288:2008 or its harmonization with ISO/IEC 12207:2008:

— Annex B provides information about use of the system life cycle processes as a process reference model to support process assessment.

— Annex C provides a description of the process constructs used in ISO/IEC 15288:2008.

— Annex D provides an example of a process view for Specialty Engineering, intended to illustrate how a project might assemble processes, activities and tasks of ISO/IEC 15288 to provide focused attention to the achievement of product characteristics that have been selected as being of special interest.

— Annex E describes the alignment of the processes of ISO/IEC 15288 and ISO/IEC 12207.

— Annex F provides support for IEEE users and describes relationships of ISO/IEC 15288:2008 to IEEE standards.

Readers of ISO/IEC 15288:2008 are advised to consult clause 5 of that International Standard to gain understanding of the key concepts used.

3.3 Context of ISO/IEC 15288:2008

ISO/IEC 15288:2008 has a focus on the processes that are used by or for a project that exists in a defined relationship with the organization, other projects and enabling systems. A project is assigned responsibility that encompasses one or more life cycle stages of the system-of-interest. ISO/IEC 15288:2008 is applicable to organizations and projects whether they act as the acquirer or the supplier of a system and whether the system is comprised of products, services, or a combination of both.

The context of ISO/IEC 15288:2008 is illustrated in Figure 1.

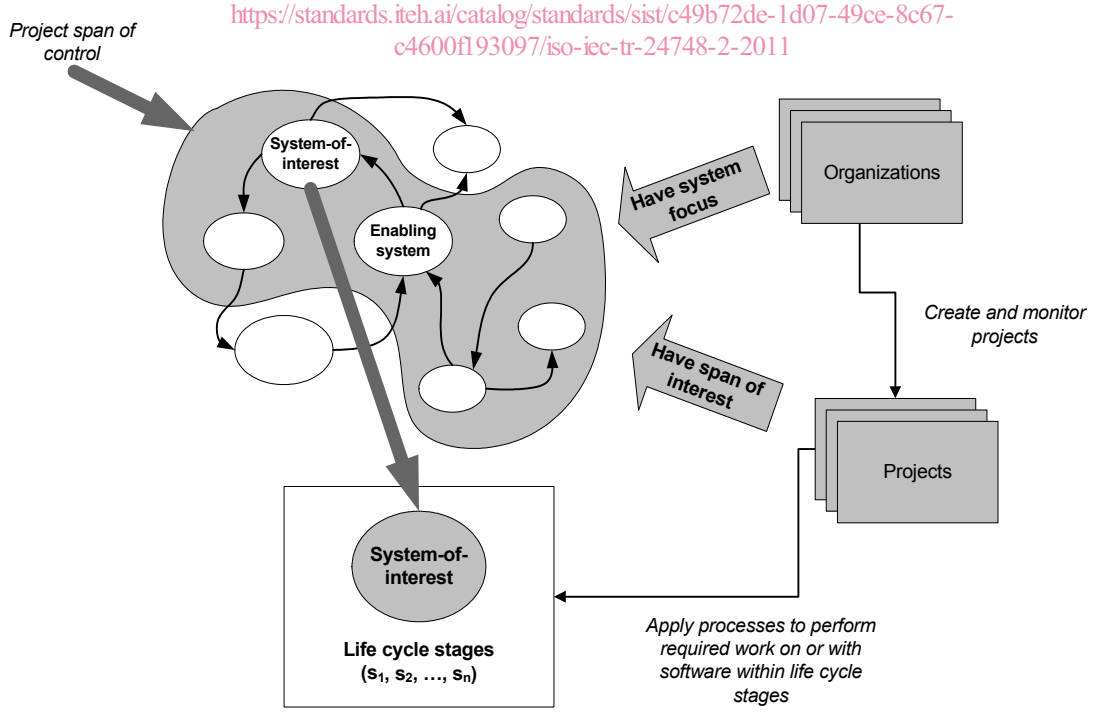

Figure 1 — Context of ISO/IEC 15288:2008

A single project may involve multiple organizations working together as partners. Such a project should use ISO/IEC 15288:2008 to establish common terminology, as well as information flows and interfaces among the several organizations to enhance communications.

When an organization applies ISO/IEC 15288:2008 to a particular system, that system becomes the system-of-interest. The system-of-interest has a life cycle that consists of multiple stages through which the system passes during its lifetime, denoted s_1, s_2, … s_n. An example of typical stages is:

— s_1: concept,

— s_2: development,

— s_3: production,

— s_4: utilization,

— s_5: support,

— s_6 retirement.

NOTE 1 Stages are described in clause 5.2.2 of ISO/IEC 15288:2008 and in clauses 3.2 and 4 of ISO/IEC TR 24748-1.

NOTE 2 The management of the progression from one stage to another and the engineering activities associated with providing appropriate work products and decision-making information are described in clause 5 of ISO/IEC TR 24748-1.

A number of enabling systems are deployed throughout the system life cycle to provide the system-of-interest with support as needed. Each life cycle stage can require one or more enabling systems. Enabling systems that cooperate with the system-of-interest during its utilization, support and retirement stages can be needed, as well. It is important to note that an enabling system has its own life cycle and that when ISO/IEC 15288:2008 is applied to it, it then becomes a system-of-interest.

NOTE 3 The role and use of enabling systems are described in clauses 4.6.3 and 5.4.3.5 of this Technical Report.

NOTE 4 For related material on enabling systems, see also clause 5.1.4 of ISO/IEC 15288 and clause 3.1.5 of ISO/IEC TR 24748-1.

ISO/IEC 15288:2008 is applicable at any level of the structure associated with a system-of-interest. As a system is decomposed recursively into its system elements, the processes of ISO/IEC 15288:2008 may be used for each system and system element in the system structure. Each system and system element has a life cycle of its own and its own set of enabling systems.

NOTE 5 For related material on system structure, see clause 5.1.3 of ISO/IEC 15288 and clause 3.1.4 of ISO/IEC TR 24748-1.

NOTE 6 A view from a project hierarchy perspective is given in Clause 4.6.4 of this Technical Report.

In order to perform needed operations and transformations upon systems during their life cycles, the organization creates and monitors projects. Projects have defined scope, resources (including time) and focus. The scope can involve managing all of the stages of the life cycle, a subset of the stages, one or more defined processes or one or more process activities. The time scale can be of varying duration, for example one hour or tens of years. The focus of the project is related to the system-of-interest and its systems and system elements in some form of system structure or stage partitioning.

NOTE 7 Related project concepts are described in Clause 4.6 of this Technical Report.

NOTE 8 System life cycle concepts are described in clause 3.2 of ISO/IEC TR 24748-1.

Organizations focus on systems that are created by projects within the organization or in conjunction with other organizations. Projects have a span of interest that includes the system-of-interest and its related

enabling systems. Some enabling systems are under direct control of the project. The system-of-interest and those enabling systems make up the project span of control.

NOTE 9 The span of interest is described in Clause 4.6.3 of this Technical Report.

The work performed by projects is on or with the system-of-interest within one or more life cycle stages. The scope of ISO/IEC 15288:2008 includes the definition of an appropriate life cycle for a system, the selection of processes to be applied throughout the life cycle and the application of these processes to fulfil agreements and achieve customer satisfaction.

ISO/IEC 15288:2008 can be applied to all types of product- or service-focused systems and system elements consisting of one or more of the following: hardware, software, humans, processes, procedures, facilities, and naturally occurring entities. The use of ISO/IEC 15288:2008 for systems within this broad scope is one of its main advantages.

The use of the standard may be adapted to accommodate the varying project requirements in treating system life cycles.

NOTE 10 This may be performed by adapting the life cycle as described in clauses 6 and 7 of ISO/IEC TR 24748-1 and tailoring described in Annex A of ISO/IEC 15288:2008.

3.4 Comparison to prior version of ISO/IEC 15288:2008

Clause 9.1 of Technical Report ISO/IEC TR 24748-1 gives extensive detailed comparison between the 2002 and 2008 versions of International Standard ISO/IEC 15288, as well as comparisons between the old and new versions of International Standard ISO/IEC 12207 and between International Standards ISO/IEC 15288 and ISO/IEC 12207. Basically:

— The structure of the processes in ISO/IEC 15288:2008 has been changed to align with the structure in ISO/IEC 12207:2008 by decomposing process activities into more detailed tasks.

— Individual processes have been adjusted in both International Standards. This mostly consists of process renaming in ISO/IEC 15288:2008, with a few processes added or combined with others, as shown in Figure 2.

ISO/IEC 15288:2002		ISO/IEC 15288:2008		
Clause	**Process**	**Clause**	**Process**	**Changes**
5	**System life cycle processes**	**6**	**System life cycle processes**	
5.1	Introduction			Deleted
5.2	Agreement processes	6.1	Agreement processes	Numbering
5.2.1	Introduction	6.1	Agreement processes	Combined into 6.1; deleted separate clause
5.2.2	Acquisition process	6.1.1	Acquisition process	Numbering
5.2.3	Supply process	6.1.2	Supply process	Numbering
5.3	Enterprise processes	6.2	Organizational project-enabling processes	Topic and title revised; numbering
5.3.1	Introduction	6.2	Organizational project-enabling processes	Combined into 6.2; deleted separate clause
5.3.2	Enterprise environment management process	6.2.2	Infrastructure management process	Topic and title revised; numbering
5.3.3	Investment management process	6.2.3	Project portfolio management process	Topic and title revised; numbering

ISO/IEC 15288:2002		ISO/IEC 15288:2008		
5.3.4	System life cycle processes management process	6.2.1	Life cycle model management process	Title revised; numbering
5.3.5	Resource management process	6.2.2	Infrastructure management process	Separated human resources from other resources; numbering
		6.2.4	Human resource management process	
5.3.6	Quality management process	6.2.5	Quality management process	Numbering
5.4	Project processes	6.3	Project processes	Numbering
5.4.1	Introduction	6.3	Project processes	Combined into 6.3; deleted separate clause
5.4.2	Project planning process	6.3.1	Project planning process	Numbering
5.4.3	Project assessment process	6.3.2	Project assessment and control process	Processes merged; numbering
5.4.4	Project control process			
5.4.5	Decision-making process	6.3.3	Decision management process	Title revised; numbering
5.4.6	Risk management process	6.3.4	Risk management process	Numbering
5.4.7	Configuration management process	6.3.5	Configuration management process	Numbering
5.4.8	Information management process	6.3.6	Information management process	Numbering
		6.3.7	Measurement process	Added
5.5	Technical processes	6.4	Technical processes	Numbering
5.5.1	Introduction	6.4	Technical processes	Combined into 6.4; deleted separate clause
5.5.2	Stakeholder requirements definition process	6.4.1	Stakeholder requirements definition process	Numbering
5.5.3	Requirements analysis process	6.4.2	Requirements analysis process	Numbering
5.5.4	Architectural design process	6.4.3	Architectural design process	Numbering
5.5.5	Implementation process	6.4.4	Implementation process	Numbering
5.5.6	Integration process	6.4.5	Integration process	Numbering
5.5.7	Verification process	6.4.6	Verification process	Numbering
5.5.8	Transition process	6.4.7	Transition process	Numbering
5.5.9	Validation process	6.4.8	Validation process	Numbering
5.5.10	Operation process	6.4.9	Operation process	Numbering
5.5.11	Maintenance process	6.4.10	Maintenance process	Numbering
5.5.12	Disposal process	6.4.11	Disposal process	Numbering
Annex A	Tailoring process	Annex A	Tailoring	Title revised

Figure 2 — Mapping of process clause sets between ISO/IEC 15288:2002 and ISO/IEC 15288:2008

4 Application concepts

4.1 Overview

This Technical Report provides guidelines for life cycle management in the field of systems. This clause highlights and explains essential concepts on which this Technical Report is based, and introduces key concepts useful in reading and applying ISO/IEC 15288:2008.

NOTE ISO/IEC TR 24748-1 provides more information on concepts related to life cycle management in general.

4.2 System concepts

Application of ISO/IEC 15288 presupposes an understanding of system concepts. System concepts for systems that are any mix of products and services are introduced in ISO/IEC 15288, clause 5.1. Additional discussion is in ISO/IEC TR 24748-1, clause 3.1.

4.3 Life cycle concepts

Application of ISO/IEC 15288 presupposes an understanding of life cycle concepts.

NOTE Life cycle concepts are introduced in ISO/IEC 15288, clause 5.2. Additional discussion is in ISO/IEC TR 24748-1 clause 3.2.

4.4 Process concepts

4.4.1 General

4.4.1.1 Introduction

Application of ISO/IEC 15288 presupposes an understanding of process concepts.

NOTE 1 Process concepts are introduced in ISO/IEC 15288, clause 5.3. Additional discussion is in ISO/IEC TR 24748-1 clause 3.3.

The focus of ISO/IEC 15288:2008 is on the processes that are applied within a life cycle. The processes can be used by organizations (for example functional organizations and projects) that play the role of acquirer, supplier (for example main contractor, subcontractor, or service provider) or management to fulfil responsibilities pertaining to the system-of-interest. Additionally, the processes in ISO/IEC 15288:2008 can be used as a reference model for assessments under ISO/IEC 15504.

A process is an integrated set of activities that transform inputs (for example a set of data such as requirements) into desired outputs (for example a set of data describing a desired solution). An activity is a set of cohesive tasks. A task is a requirement, recommendation, or permissible action, intended to contribute to the achievement of one or more outcomes of a process.

A task is expressed in the form of a requirement, self-declaration, recommendation, or permissible action. For this purpose, Note 3 of Clause 2.3 in International Standard ISO/IEC 15288:2008 carefully employs certain auxiliary verbs to differentiate between the forms of tasks:

— “Shall” is used to express a requirement of ISO/IEC 15288:2008;

— “Should” to express a recommendation;

— “May” to indicate permission.

Within a life cycle stage, processes are performed as required to achieve stated objectives. The progression of a system through its life is the result of actions managed and performed by people in one or more organizations using the processes selected for a life cycle stage.

NOTE 2 Process concepts are introduced in ISO/IEC 15288, clause 5.3, ISO/IEC 12207, clauses 5.1.9 and 5.1.10, and ISO/IEC TR 24748-1, clause 3.3.

NOTE 3 Criteria for processes are discussed in ISO/IEC 12207, clause 5.1.8, and the decomposition of processes are discussed in clause 5.1.11. ISO/IEC 15288 does not contain corresponding material.

Figure 3 illustrates example inputs and outputs of a process for engineering a system. The inputs can be either converted to desired outputs or can enable or control the conversion. Each set of these process inputs and outputs needs to be defined and managed.

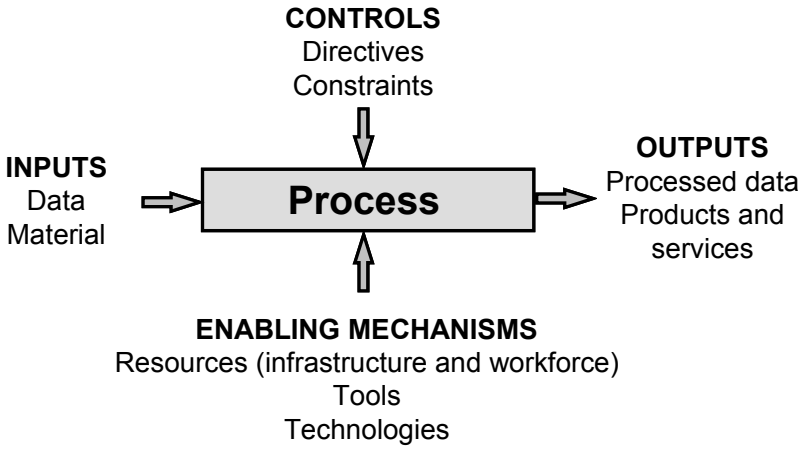

Figure 3 — Example process inputs and outputs

4.4.1.2 Inputs

Inputs can come from outside an organization or project, or from other processes that precede or accompany the process being examined. Examples of inputs to a process include:

a) Information, such as requirements, interface or architecture definitions.

b) Data, such as measurements and test reports.

c) Material that either ends up in the output or is consumed in producing the output.

d) Services that are part of a chain of services, such as setting up a computer prior to, or coincident with establishing an account.

4.4.1.3 Outputs

Outputs can go to other processes or back to the same process (recursive processing) inside the organization, project (or both), or they can go outside the project or organization, or both. Examples of outputs parallels the examples given for inputs in 4.4.1.1. However, the outputs are often (but not necessarily) transformed in some way by the process being examined.

4.4.1.4 Controls

Processes can be controlled by organizational or organization management directives and constraints and by governmental regulations and laws. Examples of such controls on a process include:

a) The project agreement.

b) The interfaces with processes used on other systems for which the project is responsible (see Clause 4.6.3 of this Technical Report).

c) The applicable system life cycle stage or stages.

d) Internal standard practices of the organization, or the part of the organization that has project responsibility.

4.4.1.5 Enabling Mechanisms

Each process can have a set of process enabling mechanisms such as listed below.

a) The workforce that performs the tasks related to the process.

b) Other resources required by the process such as facilities, equipment and funds.

c) Tools (for example software and hardware, automated, manual) required for performing the process activities.

d) Technologies required by persons performing the activities including methods, procedures and techniques

4.4.2 Process principles

4.4.2.1 Introduction

ISO/IEC 15288:2008 establishes a top-level architecture of the life cycle of systems from conception through retirement. The architecture is constructed with a set of processes and interrelationships among these processes. The processes are based on two primary principles: modularity and responsibility.

4.4.2.2 Modularity

The processes are modular, in that they are:

a) Strongly cohesive: All the parts of a process are strongly related. This reduces the dependency of one process on others, which in turn increases the efficiency with which the process can be executed;

b) Loosely coupled: The number of interfaces among the processes is kept to a minimum, which reduces the amount of communication required for each process to successfully complete.

In principle, each process is dedicated to a unique function at each usage in a given stage of the life cycle and may employ another process for a specialized function. The following presents the rules for identifying, scoping, and structuring processes:

a) A process must be modular i.e. one process should perform one and only one function within the life cycle and the interfaces between any two processes should be minimal;

b) Each process is invoked in the architecture;

c) If a process A is invoked by a process B and only process B, then A belongs to B;

d) If a function is invoked by more than one process, then the function becomes a process in itself;

e) It must be possible to verify any function within the life cycle model;

f) Each process should have an internal structure defined sufficiently to be executable.

4.4.2.3 Responsibility

The principle of responsibility is closely linked to the concept of an organization. Each process is considered the responsibility of an organization (or party). An organization may perform one or more processes. A process may be performed by one organization or more than one organization, with one of the organizations being identified as the responsible party. A party executing a process has the responsibility for that entire process even though the execution of individual tasks may be by different people.

The responsibility principle facilitates tailoring and application of ISO/IEC 15288:2008 on a project, in which many persons may be legitimately involved.

NOTE 1 ISO/IEC TR 24748-1, clause 3.3.2 provides more information on process responsibility.

NOTE 2 Organizations and parties are discussed in clause 4.6 of this Technical Report.

4.4.3 Process categories of ISO/IEC 15288:2008

The four process groups of ISO/IEC 15288 as well as the primary relationships between the groups are portrayed in Figure 4. The role of the Organizational Project-enabling and Project groups of processes is to achieve the project goals within applicable life cycle stages to satisfy an agreement. Organizational Project-Enabling processes provide enabling resources and infrastructure that are used to create, support, and monitor projects and to assess project effectiveness. The project processes ensure that adequate planning, assessment, and control activities are performed to manage processes and life cycle stages.

Appropriate processes are selected from the Technical Processes and used to populate projects in order for the project to perform life cycle related work.

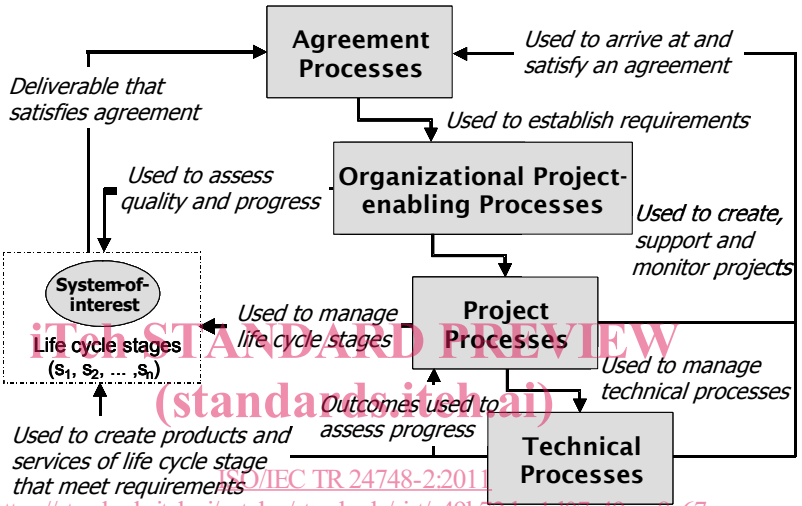

Figure 4 — Role of the ISO/IEC 15288:2008 processes

Projects may need to establish relationships with other projects within the organization, as well as those in other organizations. Such relationships are established through the agreement processes of acquisition and supply as shown in Figure 5. The degree of formality of the agreement is adapted to the internal or external business relationships between projects. An example and discussion of the use of the agreement processes is provided in Clause 5.4.2 of this Technical Report.

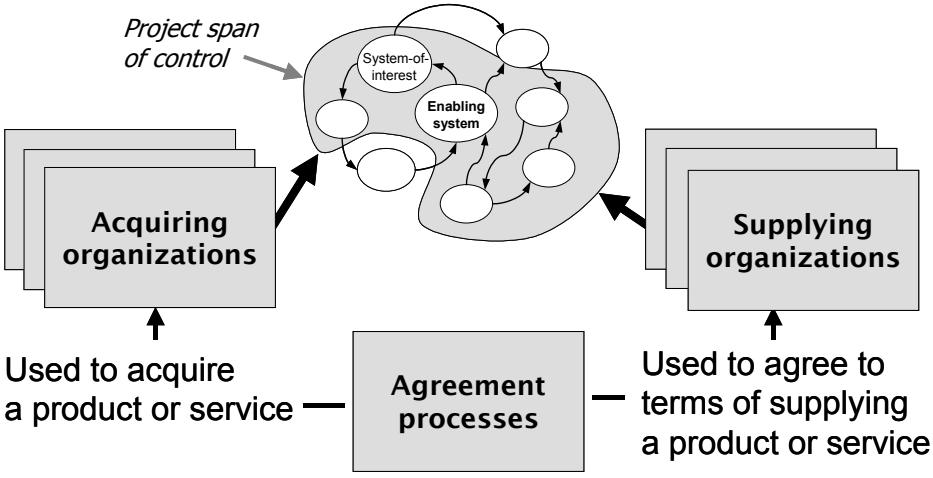

Figure 5 — Use of agreement processes