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Part 221: Human-centred design process assessment model

Ergonomie de l'interaction homme/système —

Partie 221: Modèle d'évaluation de processus de conception centrée sur l'opérateur

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Foreword

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

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This document was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 4, *Ergonomics of human-system interaction*.

A list of all parts in the ISO 9241 series can be found on the ISO website.

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

Introduction

This document focuses on the capability of human-centred design (HCD) processes and the maturity of organizations in implementing HCD.

The primary intended users of this document are internal and external assessors or well-trained UX professionals (such as HCD process managers or HCD quality managers) responsible for assessing HCD processes in organizations that need to specify, assess and improve their HCD processes, according to the process reference model (PRM) described in ISO 9241-220. The professionals responsible for institutionalizing HCD in organizations, the primary intended users of ISO 9241-220, are also important users of this document since this document intends to assess their work.

This document incorporates the processes from ISO 9241-220, as well as the process assessment model (PAM) according to the process measurement framework for the assessment of process capability in ISO/IEC 33020. The full titles of these standards are listed in the Bibliography.

Ergonomics of human-system interaction —

Part 221:
Human-centred design process assessment model

1 Scope

This document specifies the process references model (PRM) for human-centred design (HCD) according to ISO 9241-220, as well as the process assessment model (PAM) for assessing these processes, based on ISO/IEC 33020 and in accordance with the requirements of ISO/IEC 33004.

This HCD PAM contains a set of indicators to be considered while interpreting the intent of the HCD PRM defined in ISO 9241-220. These indicators can also be applied when implementing a process improvement programme post an assessment.

NOTE 1 The PRM in this document focuses on assessing HCD processes rather than system life cycle, for example as in ISO/IEC/IEEE 15288, or software life cycle, as in ISO/IEC/IEEE 12207.

NOTE 2 If processes beyond the scope of ISO 9241-220 are required, appropriate processes from other PRMs, such as ISO/IEC/IEEE 12207, ISO/IEC/IEEE 15288 or ISO/TS 18152, can be added based on the business needs of the organization.

The intended application of this document is computer-based interactive systems. While the processes apply to interactive systems that deliver services, they do not cover the design of those services. The relevant aspects of the processes can also be applied to simple or non-computer-based interactive systems.

NOTE 3 HCD concentrates on the human-centred aspects of design and not on other aspects of design, such as mechanical construction, programming or the basic design of services.

The process descriptions in this document provide the basis for a rigorous assessment of an enterprise's capability to carry out human-centred processes in conformity with the ISO/IEC 33004 and ISO/IEC 33020.

This document is intended for use by organizations that want to address and improve their treatment of human-centred design of either their internal systems or the products and services they provide, and the procurement of systems and parts of systems. The processes can be applied by small- and medium-sized enterprises as well as by large organizations.

NOTE 4 The scope of application of the PAM is the same as that of the PRM, which is described in ISO 9241-220:2019, Clause 1.

2 Normative references

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

ISO 9241-220:2019, *Ergonomics of human-system interaction — Part 220: Processes for enabling, executing and assessing human-centred design within organizations*

ISO/IEC/IEEE 24765, *Systems and software engineering — Vocabulary*

ISO/IEC/IEEE 29119-1, *Software and systems engineering — Software testing — Part 1: General concepts*

ISO/IEC/IEEE 29119-3, *Software and systems engineering — Software testing — Part 3: Test documentation*

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

ISO/IEC 33020:2019, *Information technology — Process assessment — Process measurement framework for assessment of process capability*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9241-220, ISO/IEC/IEEE 24765, ISO/IEC/IEEE 29119-1, ISO/IEC/IEEE 29119-3 and ISO/IEC 33001 and the following apply.

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

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

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

3.1.1
work product
documented information
artefact produced by a process

EXAMPLE Project plan, requirements specification, design documentation, source code, test plan, test meeting minutes, schedules, budgets and incident reports.

Note 1 to entry: Work products are evidence of the achievement of process outcomes and of the performance of the relevant activities.

[SOURCE: 9241-220:2019, 3.49, modified — Additional preferred term, "documented information", added.]

3.2 Abbreviated terms

BP	base practice
GP	generic practice
HCD	human-centred design
HCP	human-centred process
IEEE	Institute of Electrical and Electronics Engineers
PA	process attribute
PAM	process assessment model
PCI	process capability indicator
PPI	process performance indicator
PRM	process reference model
WP	work product
WPC	work product characteristic

4 Conformity

The HCD PAM and PRM conform with ISO/IEC 33004 and can be used as the basis for assessing process capability.

ISO/IEC 33020 is used as an ISO/IEC 33003-conforming measurement framework. A statement of conformity of the PAM and PRM with the requirements of ISO/IEC 33004 is provided in Annex B.

Tailoring shall conform with ISO 9241-220:2019, Clause 6 and Annex B.

5 PAM and capability determination

5.1 General

To determine the capability of human-centredness as part of the PAM, all processes defined by ISO 9241-220 are chosen as the PRM and ISO/IEC 33020 is used as measurement framework.

The measurement framework provides the necessary requirements and rules for the capability dimension (see also ISO/IEC 33020 and/or Annex A). It defines a schema which enables an assessor to determine the capability level of a given process.

5.2 Process capability levels and process attributes

A process capability level is a set of process attributes (PAs) that work together to provide a major enhancement in the capability to perform a process. PAs are features of a process that can be evaluated on a scale of achievement, as a means to measure the capability of the process. PAs are applicable to all processes. Each PA addresses a specific aspect of the capability level. The levels constitute a rational way of progressing through improvement of the capability of any process. These capability levels are defined as part of the measurement framework.

Process capability levels (Table 1) and PAs (Table 2) are identical to those defined in the process measurement framework in ISO/IEC 33020:2019, 5.2.

Table 1 — Process capability levels according to ISO/IEC 33020

Level 0: **Incomplete process purpose**	The process is not implemented or fails to achieve its process purpose.
Level 1: **Performed process**	The implemented process achieves its process purpose.
Level 2: **Managed process**	The performed process is implemented in a managed fashion (planned, monitored and adjusted) and its documented information is appropriately established, controlled and maintained.
Level 3: **Established process**	The managed process is implemented using a defined process which is assured and continually improved.
Level 4: **Predictable process**	The established process is performed predictively. Quantitative management needs are identified and measurement data are collected and analysed to identify assignable causes of variation. Corrective action is taken to address assignable causes of variation.
Level 5: **Innovating process**	The predictable process is continually improved to respond to changes through identified innovative approaches for process innovation.

Within the PAM of this document, the determination of capability is based upon the nine PAs defined in ISO/IEC 33020:2019, Table 2.

Table 2 — Process attributes according to ISO/IEC 33020

Attribute ID	Process attributes
Level 0: Incomplete process	
Level 1: Performed process	
PA 1.1	Process performance
Level 2: Managed process	
PA 2.1	Performance management
PA 2.2	Documented information management
Level 3: Established process	
PA 3.1	Process definition
PA 3.2	Process deployment
PA 3.3	Process assurance
Level 4: Predicted process	
PA 4.1	Quantitative analysis
PA 4.2	Quantitative control
Level 5: Innovative process	
PA 5.1	Process innovation

Assessment indicators are used to identify whether the process outcomes and the process attribute outcomes (achievements) are given in processes of projects in organizational units.

In this document, there are two types of assessment indicators:

— Process performance indicators (PPIs), which apply exclusively to capability level 1. They provide an indication of the extent of fulfilment of the process outcomes.

— Process capability indicators (PCIs), which apply to capability levels 1 to 5. They provide an indication of the extent of fulfilment of the process attribute achievements.

NOTE Assessment indicators are used to confirm that certain practices were performed, as shown by evidence collected during an assessment. All such evidence comes either from the examination of work products of the processes assessed or from statements made by the performers and managers of the processes. The existence of base practices and work products provide evidence of the performance of the processes associated with them. Similarly, the existence of process capability indicators provides evidence of process capability.

The evidence obtained should be recorded in a form that clearly relates to the associated assessment indicator to support the assessor's judgement that can be confirmed or verified as required by ISO/IEC 33002.

5.3 Process performance indicators

Types of PPI are:

— base practices (BPs);

— work products (WPs) [in combination with work product characteristics (WPCs)].

Both BPs and WPs relate to one or more process outcomes. Consequently, BPs and WPs are always process-specific and not generic. BPs represent activity-oriented indicators. WPs represent result-oriented indicators. Both BPs and WPs are used for judging the objective evidence that an assessor is to collect and accumulate in the performance of an assessment.

NOTE The HCD PAM offers a set of WPCs (see Annex C) for each WP. These are meant to offer a good practice and state-of-the-art knowledge guide for the assessor.

5.4 Process capability indicators

There is one type of PCI relevant for this document: generic practices (GPs).

GPs are activity-oriented indicators relating to one or more process attribute achievements. In contrast to PPIs, they are of generic type, i.e. they apply to any process.

The corresponding process capability levels and PAs for levels 0 to 5 are detailed in Clause 7.

NOTE An assessor collects and accumulates evidence supporting PCI during an assessment. In that respect, GPs are alternative indicator sets the assessor can use.

5.5 Process attribute rating

To enable the rating, the measurement framework provides PAs defining a measurable property of process capability. Each PA is assigned to a specific capability level. The extent of achievement of a certain PA is represented by means of a rating based on a defined rating scale. The rules from which an assessor can derive a final capability level for a given process are represented by a process capability level model. The HCD PAM uses the measurement framework defined in ISO/IEC 33020.

NOTE It can be seen as good practice that at least two assessors conduct a representative HCD process assessment: a lead assessor leading the assessment and a co-assessor supporting. It is useful if at least one of the assessors has experience in mapping the HCD processes of the HCD PRM to organizations.

To support the rating of PAs, the ISO/IEC 33020 measurement framework provides a defined rating scale with an option for refinement, different rating methods and different aggregation methods depending on the class of the assessment (e.g. required for organizational maturity assessments). For the rating scale within the process measurement framework, a PA is a measurable property of process capability. A PA rating is a judgement of the degree of achievement of the PA for the assessed process. The rating scale is defined by ISO/IEC 33020, as shown in Table 3.

Table 3 — Rating scale according to ISO/IEC 33020

N	Not achieved	There is little or no evidence of achievement of the defined PA in the assessed process.
P	Partially achieved	There is some evidence of an approach to, and some achievement of, the defined PA in the assessed process. Some aspects of achievement of the PA can be unpredictable.
L	Largely achieved	There is evidence of a systematic approach to, and significant achievement of, the defined PA in the assessed process. Some weaknesses related to this PA can exist in the assessed process.
F	Fully achieved	There is evidence of a complete and systematic approach to, and full achievement of, the defined PA in the assessed process. No significant weaknesses related to this PA exist in the assessed process.

For the rating of the degree of achievement of each process attribute, the rating scale of ISO/IEC 33020 is used: not achieved, partially achieved, largely achieved, fully achieved. This ordinal scale shall be understood in terms of percentage achievement of a process attribute (shown in Table 4).

Table 4 — Rating scale percentage values according to ISO/IEC 33020

N	Not achieved	0 to ≤ 15 % achievement
P	Partially achieved	> 15 % to ≤ 50 % achievement
L	Largely achieved	> 50 % to ≤ 85 % achievement
F	Fully achieved	> 85 % to ≤ 100 % achievement

The ordinal scale may be further refined for the measures P and L as defined in ISO/IEC 33020:2019, Table 5.

The rating shall follow the rating defined in Table 5.

Table 5 — Refinement of rating scale and rating criteria according to ISO/IEC 33020

N	Not achieved	0 to ≤ 15 % achievement	There is little or no evidence of achievement of the defined PA in the assessed process.
P–	Partially achieved	> 15 % to ≤ 32,5 % achievement	There is some evidence of an approach to, and some achievement of, the defined PA in the assessed process. Many aspects of achievement of the PA can be unpredictable.
P+	Partially achieved	> 32,5 % to ≤ 50 % achievement	There is some evidence of an approach to, and some achievement of, the defined PA in the assessed process. Some aspects of achievement of the PA can be unpredictable.
L–	Largely achieved	> 50 % to ≤ 67,5 % achievement	There is evidence of a systematic approach to, and significant achievement of, the defined PA in the assessed process. Many weaknesses related to this PA can exist in the assessed process.
L+	Largely achieved	> 67,5 % to ≤ 85 % achievement	There is evidence of a systematic approach to, and significant achievement of, the defined PA in the assessed process. Some weaknesses related to this PA can exist in the assessed process.
F	Fully achieved	> 85 % to ≤ 100 % achievement	There is evidence of a complete and systematic approach to, and full achievement of, the defined PA in the assessed process. No significant weaknesses related to this PA exist in the assessed process.

Rating and aggregation methods follow ISO/IEC 33020. A process outcome is the observable result of successful achievement of the process purpose. A process attribute outcome is the observable result of achievement of a specified process attribute. Process outcomes and process attribute outcomes may be characterized as an intermediate step to providing a process attribute rating. When performing rating, the rating method employed shall be specified relevant to the class of assessment. The selected rating method(s) shall be specified in the assessment input and referenced in the assessment report.

ISO/IEC 33020 provides three rating methods. Depending on the class, scope and context of the assessment, an aggregation within one process (one-dimensional, vertical aggregation), across multiple process instances (one-dimensional, horizontal aggregation) or both (two-dimensional, matrix aggregation) is performed. When performing an assessment, ratings may be summarized across one or two dimensions. The process attributes and outcomes may be attributed to be mandatory or recommended based on the cross-reference between ISO 9241-210 and ISO 9241-220 as shown in ISO 9241-220:2019, Table C.2.

For further information regarding rating methods, see ISO/IEC 33020.

5.6 Process capability level model

The process capability level model defines the rules for how the achievement of each level depends on the rating of the PAs for the assessed and all lower process capability levels. The process capability levels are defined in detail in Clause 7.

The process capability level achieved by a process shall be derived from the PA ratings for that process according to the process capability level model defined in Table 6.

Table 6 — Detailed process capability level model according to ISO/IEC 33020

Scale	Process attribute	Rating
Level 1	PA 1.1: Process Performance	Largely or fully
Level 2	PA 1.1: Process Performance	Fully
	PA 2.1: Performance Management	Largely or fully
	PA 2.2: Documented Information Management	Largely or fully

Table 6 *(continued)*

Scale	Process attribute	Rating
Level 3	PA 1.1: Process Performance	Fully
	PA 2.1: Performance Management	Fully
	PA 2.2: Documented Information Management	Fully
	PA 3.1: Process Definition	Largely or fully
	PA 3.2: Process Deployment	Largely or fully
	PA 3.3: Process Assurance	Largely or fully
Level 4	PA 1.1: Process Performance	Fully
	PA 2.1: Performance Management	Fully
	PA 2.2: Documented Information Management	Fully
	PA 3.1: Process Definition	Fully
	PA 3.2: Process Deployment	Fully
	PA 3.3: Process Assurance	Fully
	PA 4.1 Quantitative Analysis	Largely or fully
	PA 4.2: Quantitative Control	Largely or fully
Level 5	PA 1.1: Process Performance	Fully
	PA 2.1: Performance Management	Fully
	PA 2.2: Documented Information Management	Fully
	PA 3.1: Process Definition	Fully
	PA 3.2: Process Deployment	Fully
	PA 3.3: Process Assurance	Fully
	PA 4.1: Quantitative Analysis	Fully
	PA 4.2: Quantitative Control	Fully
	PA 5.1: Process Innovation	Largely or fully

As indicated in Table 6, to reach the next capability level all prior PAs of the former capability levels shall be achieved fully.

As a general rule, the achievement of a given level requires a large achievement of the corresponding PAs and a full achievement of any lower-lying PA.

A process assessment is a disciplined evaluation of an organizational unit's processes against a PAM. The PAM offers process indicators that provide guidance for assessors in accumulating the necessary objective evidence to support judgements of the capability of the processes. They are not intended to be regarded as a mandatory set of checklists to be followed. To judge the presence or absence of process outcomes and process achievements, an assessment obtains objective evidence. All such evidence comes from the examination of work products and repository content of the assessed processes, and from testimony provided by the performers and managers of the assessed processes. This evidence is mapped to the process indicators to allow the establishment of the correspondence to the relevant process outcomes and PA achievements.

Although Level 1 capability of a process is only characterized by the measure of the extent to which the process outcomes are achieved, the measurement framework requires each level to reveal a PA, and thus requires the PAM to introduce at least one PCI for each capability level. Therefore, the only PCI for capability Level 1 (PA.1.1) has a single generic practice (GP 1.1.1) pointing as an editorial reference to the respective PPIs (see Figure A.1 in Annex A).

Detailed information about performing an assessment can be found in ISO/IEC 33002 regarding assessment activities, roles, responsibilities and competences, assessment types and assessment documentation. An example of how an assessment for information technology works in detail can be

found in ISO/IEC TS 33030. ISO/IEC TS 33060 contains a process assessment model for general system life cycle processes.

The terminology used to plan, perform and document an assessment can be found in the following sources:

a) ISO/IEC 33001 for assessment-related terminology;

b) ISO/IEC/IEEE 24765 and ISO/IEC/IEEE 29119 terminology (contained in Annex C);

c) terms introduced by ISO/TC 159/SC 4 (contained in Annex C).

6 Process reference model (PRM) and process performance indicators (PPIs) (Level 1)

6.1 General

Figure 1 summarizes the HCD process categories and illustrates the different levels in an organization and their responsibilities for human-centred quality.

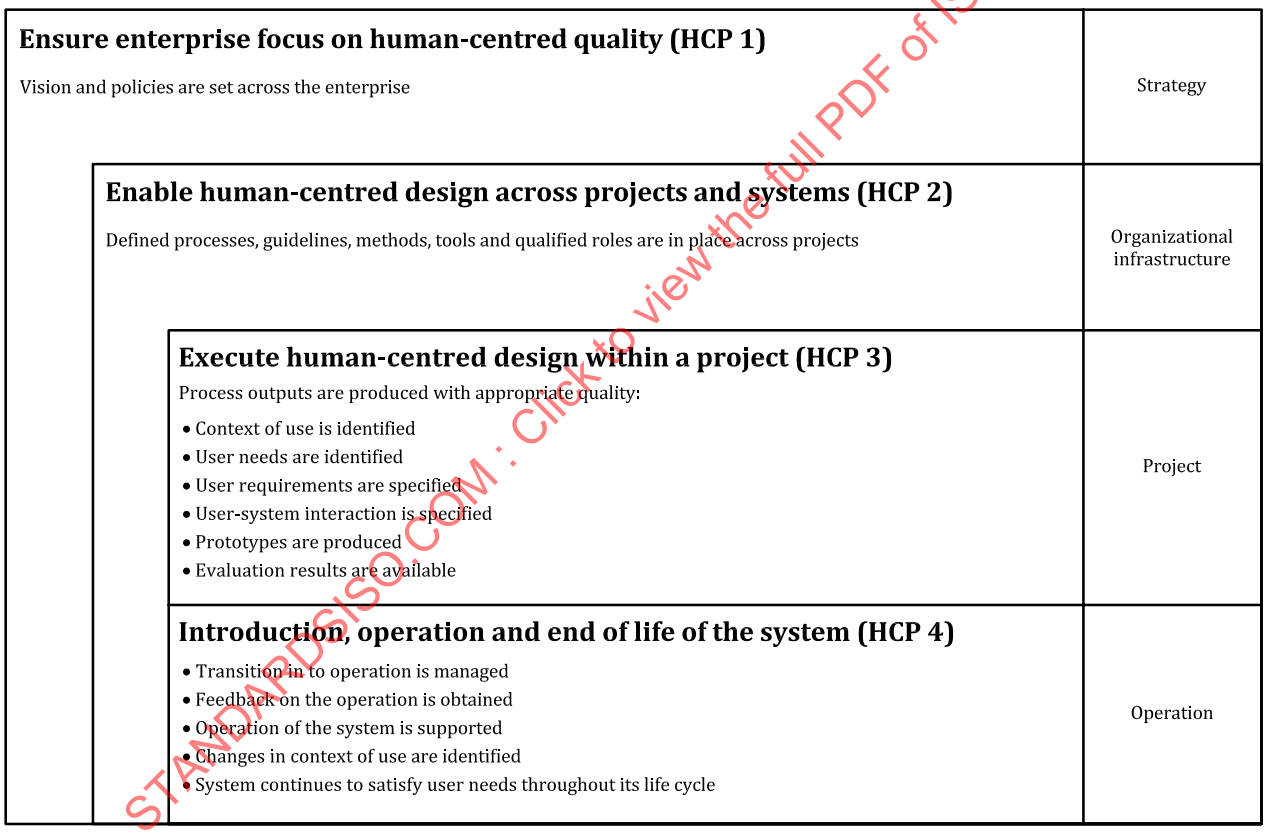

Figure 1 — HCD processes

It is a responsibility of the top management in an organization to set vision and policies for how human-centred quality can be addressed by HCD (HCP.1). HCD across projects and systems is enabled by those responsible for (project) programme management and/or the operation of systems (HCP.2). The execution of HCD within projects and the introduction, operation and end of life of systems is carried out by people with the necessary competence within each project (HCP.3 and HCP.4). It is possible that each process category is carried out by a different organizational entity or by a combination of entities. The HCD PRM from ISO 9241-220 contains HCD processes for the process groups HCP.1 to HCP.4 (Table 7).

Table 7 — HCD process reference model from ISO 9241-220

Unique identifier	Process name	Primary audiences
HCP.1	**Ensure enterprise focus on human-centred quality**	Executive responsible for human-centred quality Ensures: executive management
HCP.1.1	Incorporate human-centred quality in business strategy	
HCP.1.2	Institutionalize human-centred quality	
HCP.2	**Enable human-centred design across projects and systems**	Those responsible for (HCD) processes used by the organization Ensures: project, product and usability management
HCP.2.1	Integration of human-centred design	
HCP.2.2	Resources for human-centred design	
HCP.2.3	Authorization and control of human-centred quality	
HCP.3	**Execute human-centred design within a project**	Technical leadership responsible for HCD Ensures: project and product management
HCP.3.1	Plan and manage human-centred design for the project	
HCP.3.1.1	Establish human-centred quality objectives	
HCP.3.1.2	Manage threats and opportunities that can arise from use of the interactive system	
HCP.3.1.3	Define extent of human-centred design in the project	
HCP.3.1.4	Plan each HCD process activity	
HCP.3.1.5	Manage HCD process activities within the project	
HCP.3.2	Identify the context of use	
HCP.3.2.1	Identify the intended user population and differentiate groups of users	
HCP.3.2.2	Identify other aspects of the context of use and reported issues	
HCP.3.3	Establish the user requirements	
HCP.3.3.1	Identify the user needs	
HCP.3.3.2	Specify the user requirements	
HCP.3.3.3	Negotiate the user requirements in the context of a project	
HCP.3.4	Design solution that meets user requirements	
HCP.3.4.1	Specify the user-system interaction	
HCP.3.4.2	Produce and refine user interface design solutions	
HCP.3.5	User-centred evaluation	
HCP.3.5.1	Plan for evaluation throughout the project	
HCP.3.5.2	Plan each evaluation (what to evaluate and how)	
HCP.3.5.3	Carry out each evaluation	
HCP.4	**Introduction, operation and end of life of a system**	Technical leadership responsible for HCD Ensures: service and support management
HCP.4.1	Introducing the system	
HCP.4.2	Human-centred quality in operation	
HCP.4.3	Human-centred quality during upgrades	
HCP.4.4	Human-centred quality at the end of life of a system	

Each table related to one process in the process dimension contains the PRM and the PPIs necessary to define the PAM (Table 8). The PPIs consist of base practices, input work products and output work products.

NOTE 1 The processes in the process dimension (Table 7) are taken from the HCD PRM in ISO 9241-220. These are reproduced in Tables 9 to 32.

NOTE 2 Table 7 also lists the primary audiences for each process category.

NOTE 3 Work product characteristics and types are defined in Annex C. The work product ID is not related to the process ID. Indicators in brackets after the output work product name in Tables 9 to 32 refer to process outcome.

Table 8 — Template for the process description

PRM	Process ID	The individual processes are described in terms of process name, process purpose, process benefit and process outcomes to define the human-centred PRM. Additionally, a process identifier is provided.
	Process name	
	Process purpose	
	Process benefit	
	Process outcomes	
PPIs	BPs	A set of BPs for the process, providing a definition of the tasks and activities needed to accomplish the process purpose and fulfil the process outcomes.
	Input WPs	A number of input WPs associated with each process. See Annex C for the characteristics associated with each WP.
	Output WPs	A number of output WPs associated with each process. See Annex C for the characteristics associated with each WP.

6.2 HCP.1 process group: ensure enterprise focus on human-centred quality

6.2.1 Purpose and outcomes of HCP.1

The main audience for this set of processes is executives and management who understand that human-centred quality provides opportunities and addresses risks related to organizational or business success, corporate image or society, customer confidence, staff motivation and human-system issues in governance and services.

NOTE The content of this set of processes is likely to be communicated to executives and management by specialists who are familiar with the content of this document.

The purpose of this set of processes is to establish and maintain awareness and sensitivity to satisfying stakeholder and user needs for human-centred quality across the organization and make these needs an inherent element in an organization's business strategy.

The outcomes achieved by this set of processes are as follows:

— human-centred quality of interactive systems is treated as a corporate asset across the organization;

— policies for achieving required levels of human-centred quality are set (demonstrating senior management support for the improvement of infrastructure related to human-centred quality);

— institutionalization of human-centred design in the organization is managed;

— the organization employs HCD activities to maintain an appropriate level of human-centred quality:

  — across systems, products and services;

  — over time;

— in the market and workplace;

— human effectiveness, cost and risk analysis results are taken into account in investment decisions.

These outcomes are achieved by performance of the processes addressed in Tables 9 and 10.

6.2.2 HCP.1.1 – Incorporate human-centred quality in business strategy

Table 9 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.1.1.

Table 9 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.1.1

Process ID	HCP.1.1
Process name	**Incorporate human-centred quality in business strategy**[a]
Process purpose	Explicitly take account of the human-centred quality of interactive systems in an organization's business strategy.
Process benefit	The organization and affected stakeholders benefit from improved human-centred quality.
Process outcomes	As a result of successful implementation of this process: a) Analysis is carried out of opportunities for the organization related to human-centred quality, including the understanding and mitigation of risks. b) A corporate vision of human-centred quality as a corporate asset is created. c) Strategic objectives for the human-centred quality of the organization's interactive systems in the market or workplace are set. d) Objectives for human-centred quality are included in the organization's business operational targets. e) Investment in interactive systems takes account of the contribution of human-centred design to business effectiveness, cost benefits and risk analysis. f) Necessary resources for addressing human-centred quality are available.

[a] This applies to both the human-centred quality of interactive systems acquired for use and those designed and developed by an organization.

[b] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

[c] It is possible that this work product will be changed by this process.

[d] Work product characteristics and work product types are defined in Annex C using work product IDs (e.g. 03.02).

Table 9 *(continued)*

Process ID	HCP.1.1
Base practices	**HCP.1.1.BP1: Determine the extent to which improved human-centred quality of interactive systems presents opportunities for the organization and poor human-centred quality of interactive systems is a threat for the organization.** For a generic product, the only user could be the purchaser of the system. For a larger or more complex system, there will be more stakeholders and a user organization, but there are still different types of users with different contexts of use. Objectives are ideally set as measurable criteria. At an early stage, stakeholders other than users could also be involved. However, user involvement is a principle of ISO 9241-210. [a, b] [b] **HCP.1.1.BP2: Decide how the organization will identify the objectives for the human-centred quality of its interactive systems.** [c] **HCP.1.1.BP3: Define strategic human-centred quality objectives** for interactive systems. [c, d] **HCP.1.1.BP4: Assess how human-centred quality is related to business benefits for the organization.** [d, e] **HCP.1.1.BP5: Explicitly plan for human-centred quality in financial management of programmes and infrastructure.** [c, d, e, f] **HCP.1.1.BP6: Analyse social, educational and technological trends in staff and users.** [c, f]
Input work products	03.02 Supply strategy[c,d] 03.03 Business strategy[c,d] 06.10 Customer satisfaction report[d] 08.08 Quality management goals and objectives[c,d]
Output work products	03.02 Supply strategy [c][c,d] 03.03 Business strategy [b][c,d] 06.06 Investment decision report [e][d] 08.08 Quality management goals and objectives [d][c,d]

[a] This applies to both the human-centred quality of interactive systems acquired for use and those designed and developed by an organization.

[b] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

[c] It is possible that this work product will be changed by this process.

[d] Work product characteristics and work product types are defined in Annex C using work product IDs (e.g. 03.02).

6.2.3 HCP.1.2 – Institutionalize human-centred quality

Table 10 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.1.2.

Table 10 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.1.2

Process ID	HCP.1.2
Process name	**Institutionalize human-centred quality**
Process purpose	Establish and maintain a human-centred approach as normal practice in the organization.
Process benefit	The organization takes account of human-centred quality

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

[b] It is possible that this work product will be changed by this process.

Table 10 *(continued)*

Process ID	HCP.1.2
Process outcomes	a) Top management promotes a human-centred approach to system design, operation and procurement. b) The organization has a strategic vision for the value of taking account of user experience both for its products and systems for staff use. c) The extent to which targets for human-centred quality need to be achieved for different products or market segments is known. d) Human-centred design is applied in the development of interactive systems. e) The enterprise is responsive to changes in how their interactive systems are used.
Base practices	**HCP.1.2.BP1: Designate a suitable member of the executive board** to be responsible for championing a human-centred approach and getting top management endorsement. [a][a] **HCP.1.2.BP2: Establish and communicate a policy** for achieving required levels of human-centred quality in the organization. [a] **HCP.1.2.BP3: Establish a continuous improvement programme** for human-centred quality in the organization. [a] **HCP.1.2.BP4: Establish and maintain awareness** of the importance of human-centred quality. [b] **HCP.1.2.BP5: Assess and define the importance** of human-centred quality in different market segments, taking account of the expectations for human-centred quality of the products in those market segments. [c] **HCP.1.2.BP6: Ensure acceptance** of human-centred activities in the organization. [d] **HCP.1.2.BP7: Develop the systems strategy** to take account of user, other stakeholder and organizational requirements. [e]
Input work products	03.02 Supply strategy[b] 03.03 Business strategy 03.04 System life cycle management policy[b] 06.04 System life cycle model review
Output work products	03.01 Acquisition strategy [b] 03.02 Supply strategy [b][b] 03.08 Quality management policy [c] 03.04 System life-cycle management policy [d][b] 04.03 Quality management system [a, c] 06.07 System life cycle process review [e]

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

[b] It is possible that this work product will be changed by this process.

6.3 HCP.2 process group: enable human-centred design across projects and systems

6.3.1 Purpose and outcomes of HCP.2

The main audience for this set of processes is business unit or department, portfolio, programme, product and HCD managers, process owners and technical specialists with cross-project or organizational responsibilities. The types of risks addressed include threats to the corporate image or society, business survival and human-system issues in governance and services.

The outcomes achieved by this set of processes are as follows:

— the overall system development project plan (for each interactive system and across interactive systems) incorporates human-centred quality;

— business planning for each project implements the vision for human-centred quality in terms of:

  — usability;

  — accessibility;

  — user experience;

  — avoidance of harm from use;

— appropriate procedures for achieving required levels of human-centred quality by HCD activities exist:

  — for systems, products, services;

  — to support interoperability, integration, consistency of use across systems, products, services;

  — across user groups;

  — over time;

— an organizational infrastructure and staff for HCD processes is established, promoted and maintained;

— human-centred quality is an inherent element in the process of acquisition, supply and operation of each interactive system and across interactive systems, facilitating co-existence and interoperability of interactive systems;

— trade-off and risk management explicitly include human-centred quality in mitigating risks;

— human factors data necessary for the organization to carry out human-centred design and maintain acceptable levels of human-centred quality are available.

These outcomes are achieved by performance of the processes addressed in Tables 11 to 13.

6.3.2 HCP.2.1 – Integration of human-centred design

Table 11 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.2.1.

Table 11 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.2.1

Process ID	HCP.2.1
Process name	**Integration of human-centred design**
Process purpose	To ensure that the organization has procedures that enable human-centred design to be appropriately integrated into all phases of the life cycle for interactive systems.
Process benefit	Human-centred design is used appropriately.
[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.	
[b] It is possible that this work product will be changed by this process.	

Table 11 *(continued)*

Process ID	HCP.2.1
Process outcomes	a) The organization has a shared understanding of human-centred design and how it is achieved. b) Human-centred design is a documented part of the systems development process and the overall system development project plan (for each interactive system and across interactive systems). c) Procedures are defined for integrating HCD activities with other system development activities. d) An effective mechanism is established for personal and technical communication related to human system issues. e) Strategic human-system issues and associated risks of harm related to systems and their use are identified and managed. f) The costs and benefits of particular HCD activities and the risks mitigated are known. g) Stakeholders relevant to the human-centred approach are involved. h) Human-centred quality objectives are included in the procurement process. i) Marketing and other relationships with external entities explicitly take account of human-centred quality as appropriate.
Base practices	**HCP.2.1.BP1: Establish a common terminology for human-system issues** within the organization. [a][a] **HCP.2.1.BP2: Integrate human-centred design into the overall system development project plan.** [b, c] **HCP.2.1.BP3: Collect feedback on the management of human-system issues** across the organization. [d] **HCP.2.1.BP4: Develop effective procedures for communication** between those responsible for human-centred design and other members of project teams. [c, d] **HCP.2.1.BP5: Identify emerging human-system issues** for the organization. [e, f] **HCP.2.1.BP6: Identify and integrate stakeholders** relevant to the human-centred approach. [g] **HCP.2.1.BP7: Explicitly take account of human-centred quality in procurement**. [h] **HCP.2.1.BP8: Analyse image, client-relationships and competitive situation in the marketplace** with respect to a human-centred approach. [i] The marketing function in an organization typically provides: — information on target user groups; — insights on key drivers of user satisfaction; — prioritization guidance based on the market situation; — objective sales data that can be correlated with usability data – for validation and ROI assessment.

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

[b] It is possible that this work product will be changed by this process.

Table 11 *(continued)*

Process ID	HCP.2.1
Input work products	3.04 System life cycle management policy[b] 3.06 System life cycle process policy[b] 3.08 Quality management policy 6.07 System life cycle process review
Output work products	2.01 System life cycle stage model [a] 3.04 System life cycle management policy [b][b] 3.06 System life cycle process policy [c][b] 3.11 Technical management plan [d, f] 3.08 Quality management policy [h][b] 6.08 System life cycle improvement report [e, f]
[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes. [b] It is possible that this work product will be changed by this process.	

6.3.3 HCP.2.2 – Resources for human-centred design

Table 12 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.2.2.

Table 12 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.2.2

Process ID	HCP.2.2
Process name	**Resources for human-centred design**
Process purpose	To establish and maintain an effective infrastructure for human-centred design within the organization.
Process benefit	Human-centred design can be carried out as appropriate by each project.
Process outcomes	a) An agreed set of suitable HCD procedures, tools and methods representing accepted practice is used to address human-centred quality. b) Agreed HCD procedures are maintained in suitable format(s) for effective and widespread use by project members. c) Accepted design guidelines, standards and human factors data related to human-centred quality are provided and maintained in suitable format(s) for effective and widespread use by project stakeholders. d) Sufficient staff competent in human-centred design are available for all projects. e) Guidance on selecting, adapting and applying individual tools and methods to be confident that the required level of human-centred quality will be achieved is available. f) Guidance on how to assign sufficient time and budget to be confident that the required level of human-centred quality will be achieved is available.
[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes. [b] It is possible that this work product will be changed by this process.	

Table 12 *(continued)*

Process ID	HCP.2.2
Base practices	**HCP.2.2.BP1: Define an authority** to be responsible for maintaining and promoting the infrastructure for human-centred design (procedures, tools, methods, training and mentoring). [a, b][a] **HCP.2.2.BP2: Select, publish, review and maintain HCD procedures, tools and methods** that are usable by the organization. [b] This includes checking whether methods are used appropriately, i.e. produce valid results, and revising as necessary. **HCP.2.2.BP3: Define required competences** in human-centred design and appropriate assessment methods. [d] **HCP.2.2.BP4: Establish training** to reach and maintain required competences in human-centred design. [d] **HCP.2.2.BP5: Ensure that staff are competent (including any necessary training)** to apply selected procedures, tools and methods (including customising for the project context where appropriate). [d, e, f] **HCP.2.2.BP6: Mentor and monitor trained individuals** to ensure that competence is effectively applied in the working environment. [d, f] **HCP.2.2.BP7: Select, publish and maintain design and usability (style) guidelines, standards and other information** (e.g. advice on customization and resourcing) related to human-centred quality within the organization. [c, e, f] Principles, requirements and recommendations are published in various sources, including the ISO 9241 series. These typically apply across user interface platforms, e.g. "colour should be used only as an additional means to code information". See Reference [27].
Input work products	03.04 System life cycle management policy 03.06 System life cycle process policy[b] 03.07 Training strategy[b] 03.08 Usability management policy
Output work products	01.03 Competent personnel register [d] 02.04 System life cycle process model [a, b] 03.06 System life cycle process policy [a][b] 03.07 Training strategy [d][b] 03.11 Technical management plan [c, e, f] The technical management plan includes HCD procedures, as well as HCD design guidelines, standards and other human factors data related to human-centred quality.

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

[b] It is possible that this work product will be changed by this process.

6.3.4 HCP.2.3 – Authorization and control of human-centred quality

Table 13 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.2.3.

Table 13 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.2.3

Process ID	HCP.2.3
Process name	**Authorization and control of human-centred quality**
Process purpose	The governance of human-centred design to achieve appropriate levels of human-centred quality in the acquisition, supply and operation of interactive systems.
Process benefit	Appropriate levels of human-centred quality are achieved across the organization.
Process outcomes	a) Organization-wide objectives (HCP.3.1.1) for human-centred quality are defined. b) A governance process is established to manage projects' conformity with agreed standards. c) Human-centred quality is identified as criteria for approval of interactive systems and their elements. d) Performance against organizational objectives for human-centred quality is known. e) Deficiencies in human-centred quality are addressed. f) Acquisition includes requirements for human-centred quality. g) HCD practice and capability are contractual requirements on supplying organizations.
Base practices	**HCP.2.3.BP1: Define organization-wide objectives for human-centred quality** based on the strategic objectives set in HCP.1.1 c), for example KPIs for human-centred quality and human-centred design. [a][a] **HCP.2.3.BP2: Establish a governance process** to manage the project's conformity with agreed human-centred quality-related standards. [b] **HCP.2.3.BP3: Include review and sign-off of human-centred quality in all reviews and decisions.** [c] **HCP.2.3.BP4: Monitor the achievement of objectives for human-centred quality.** [c, d] **HCP.2.3.BP5: Take corrective action** when deficiencies in human-centred quality are identified. [e] **HCP.2.3.BP6: Include requirements for human-centred quality in the criteria for acquisition.** [f] **HCP.2.3.BP7: Assess and improve HCD capability** in organizations carrying out design and development of interactive systems. [g]
Input work products	03.01 Acquisition strategy[b] 04.01 Supplier selection procedure[b] 04.03 Quality management system[b] 06.01 Supplier assessment report 06.02 Delivery acceptance report 06.11 Quality management report

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

[b] It is possible that this work product will be changed by this process.

Table 13 *(continued)*

Process ID	HCP.2.3
Output work products	03.01 Acquisition strategy [c, f][b] 03.02 Supply strategy [c] 04.01 Supplier selection procedure [c, f] [b] 04.03 Quality management system [b, c, e][b] 06.03 Supply performance report [d] 07.02 Acquisition agreement change request [e] 07.03 Supply proposal [c, g] 07.06 Supplier directive [c, e] 08.02 Delivery acceptance criteria [c, f, g] 08.03 Supply agreement [b, g] 08.09 Quality measures [a] An organization can be either an acquirer or a supplier. Quality criteria are applicable to internal projects as well as external acquisition.
[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes. [b] It is possible that this work product will be changed by this process.	

6.4 HCP.3 process group: execute human-centred design within a project

6.4.1 Purpose and outcomes of HCP.3

The main audience for this set of processes and its sub-processes is project managers, product managers, senior HCD professionals, educators and trainers. The types of risks of harm addressed include human-system issues in the project and the system, and the quality of the system.

The purpose of this set of processes is to carry out HCD activities as appropriate in order to ensure that the system achieves appropriate human-centred quality.

NOTE Human-centred design is required to ensure human-centred quality for all types of projects, whether acquisition of a standard product, customization for use in a specific organizational context or development of a new system.

The outcomes achieved by this set of processes are as follows:

— designs or redesigns are based on user and other stakeholder requirements;

— appropriate HCD process activities are performed;

— appropriate methods are applied;

— work products contain the required content;

— appropriate human-centred quality is achieved.

This set of processes provides a means of conforming to the requirements of ISO 9241-210. These outcomes are achieved by performance of the following processes.

6.4.2 HCP.3.1 process sub-group: plan and manage human-centred design for the project

6.4.2.1 Overall purpose and outcomes of HCP.3.1

The purpose of the following set of processes is to ensure that human-centred design is conducted in a systematic manner within a project and can be traced throughout the project.

The outcomes achieved by this set of processes are as follows:

— project stakeholders know which work products are needed in order to address human-centred quality;

— human-centred design is integrated in the overall project plan;

— human-centred design is conducted in a systematic manner;

— users are involved throughout the project;

— design is driven and refined by user-centred evaluation.

These outcomes are achieved by performance of the processes addressed in Tables 14 to 18.

6.4.2.2 HCP.3.1.1: establish human-centred quality objectives

Table 14 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.3.1.1.

Table 14 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.3.1.1

Process ID	HCP.3.1.1
Process name	**Establish human-centred quality objectives**
Process purpose	Human-centred quality objectives for the project are defined and maintained, taking account of the benefits and potential negative consequences identified in HCP.3.1.2, preliminary information about context of use (HCP.3.2) and user needs (HCP.3.3.1).
Process benefit	The project is guided by objectives for human-centred quality. These provide a basis for managing threats and opportunities (HCP.3.1.2), defining the extent of HCD activities (HCP.3.1.3), and for providing user requirements and setting acceptance criteria (HCP.3.3.2).
Process outcomes	a) Human-centred quality objectives are derived from organizational objectives, business context, technological constraints and the intended context of use. b) Human-centred quality objectives are established and maintained for each applicable component of human-centred quality for each context of use: — Avoidance of harm where appropriate. EXAMPLE 1 The design of the medical device will ensure that use errors that cause harm are either eliminated or reduced to the extent possible. — Usability. EXAMPLE 2 The average time that air passengers entering the United States will take to pass through immigration is half the average time currently taken, while maintaining current levels of security and safety in screening arrivals.
[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes. [b] CIF.5 includes human-centred quality objectives.	

Table 14 *(continued)*

Process ID	HCP.3.1.1
	— Accessibility to enable the system to be used by people with the widest range of capabilities in the intended user populations, where appropriate. EXAMPLE 3 The intended user population that is identified explicitly includes users with the widest possible range of diverse human needs and characteristics. — User experience resulting from use and/or anticipated use. EXAMPLE 4 Potential users anticipate that the new product will maintain the company's reputation as the market leader for quality and innovation. EXAMPLE 5 Users enjoy the aesthetic experience of the physical design. c) Data collection (user research) is planned and resourced according to the needs of the project. d) Identified human-centred quality objectives are an integral part of the project success criteria.
Base practices	**HCP.3.1.1.BP1: Review the relevant aspects of the context of use** in order to identify relevant human-centred quality objectives. [a][a] Human-centred quality objectives vary in level and detail from very high-level visions to precise target numerical values, depending on the maturity of understanding of the system and available information at the time they are stated. The more specific human-centred quality objectives are, the more they can serve as requirements for the future system. Additional human-centred quality objectives can emerge with increased understanding of the context of use. **HCP.3.1.1.BP2: Identify differences in human-centred quality objectives between the intended user populations** (when there is more than one user population). [b] **HCP.3.1.1.BP3: Analyse the overall project objectives with respect to the impact of human-centred quality.** [a, b] **HCP.3.1.1.BP4: Identify value-driven human-centred quality objectives** for usability, accessibility, user experience and avoidance of harm from use. [b] **HCP.3.1.1.BP5: Identify areas where more information is needed** to further develop the detail of the human-centred quality objectives and of the context of use. [c] **HCP.3.1.1.BP6: Communicate the human-centred quality objectives** to relevant project stakeholders. [d]
Input work products	CIF.3 Context of use 08.03 Supply agreement 08.12 Stakeholder requirements
Output work products	CIF.5 User requirements [b][b] 08.04 Project requirements [c, d]
[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes. [b] CIF.5 includes human-centred quality objectives.	

6.4.2.3 HCP.3.1.2 – Manage threats and opportunities that arise from use of the interactive system

Table 15 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.3.1.2.

Table 15 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.3.1.2

Process ID	HCP.3.1.2
Process name	**Manage threats and opportunities that arise from use of the interactive system**
Process purpose	To manage threats and opportunities related to the degree of usability, accessibility and/or user experience achieved, including issues such as inconvenience, financial harm, health, safety, privacy and security.
Process benefit	Harm that results from inadequate usability, accessibility or user experience is minimized, and opportunities provided by superior levels of human-centred quality are realized (see ISO 9241-220:2019, Annex F for more details).
Process outcomes	a) The potential threats and opportunities related to human-centred quality are taken into account in the business case. b) The benefits of good human-centred quality are achieved for the project stakeholders for whom the success of the system is critical. c) Reasonably foreseeable harm from use is minimized or eliminated, in particular negative consequences for stakeholders for whom the success of the project or system is critical (e.g. to health, safety, finances or the environment). d) Potential opportunities related to use are considered. e) Potential conflicts between human-centred quality and other quality attributes are identified. f) Project resources for HCD are determined, based on the identified range and depth of analysis needed and an explicit assessment of threats and opportunities related to human-centred quality and health and safety.

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

[b] It is possible that this work product will be changed by this process.

Table 15 *(continued)*

Process ID	HCP.3.1.2
Base practices	**HCP.3.1.2.BP1: Incorporate issues related to human-centred quality in the development of the business case.** [a][a] **HCP.3.1.2.BP2: Identify project stakeholders for whom the success of the system is critical.** [65] [b, c] **HCP.3.1.2.BP3: Establish benefits that result from superior human-centred quality.** [b, d] EXAMPLE 1 Medical application: to have patients spend fewer days needing dialysis. EXAMPLE 2 Consumer product: to have fewer customers initiating service calls. **HCP.3.1.2.BP4: Assess the harm that results from poor human-centred quality** (for the users, organization or project, including to economic status, human life, health or the environment). [c] EXAMPLE 3 Administrative data required by expense reporting application: results in members of staff spending more time entering additional data. **HCP.3.1.2.BP5: Assess potential health and safety hazards**, including specific software-related risks (e.g. motion sickness in virtual reality) and general environments risks (e.g. physiological). [c] **HCP.3.1.2.BP6: Consider potential opportunities** based on user needs and human-centred quality (e.g. for innovative solutions). [d] **HCP.3.1.2.BP7: Resolve potential conflicts** between human-centred quality and other quality attributes (e.g. usability versus security or with buy-or-build decisions related to off-the-shelf components). [e] **HCP.3.1.2.BP8: Determine the range and depth of analysis of the interactive system** that is required to ensure human-centred quality (e.g. the related systems required to complete the task or the extent to which subsystems are analysed). [f] **HCP.3.1.2.BP9: Determine project resources** (including access to users) needed to mitigate risks to achievement of the required human-centred quality. [f]
Input work products	CIF.3 Context of use CIF.5 User requirements 08.04 Project requirements[b] 08.12 Stakeholder requirements
Output work products	03.14 Decision-making strategy [a, d, e] 03.15 Risk management strategy [c, d] 05.04 Risk register [c, e] 06.18 Risk management report [f] 08.04 Project requirements [f][b]
[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes. [b] It is possible that this work product will be changed by this process.	

6.4.2.4 HCP.3.1.3 – Define extent of human-centred design in the project

Table 16 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.3.1.3.

Table 16 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.3.1.3

Process ID	HCP.3.1.3
Process name	**Define extent of human-centred design in the project**
Process purpose	To define the HCD process outcomes and activities for the project and identify the appropriate level of HCD resources for the project.
Process benefit	The resources necessary to achieve the required level of human-centred quality are defined and integrated in the overall project plan.
Process outcomes	a) The scope of HCD process outcomes and activities needed to achieve the objectives identified by HCP.3.1.1 and the benefits identified by HCP.3.1.2 are defined. b) HCD methods are selected and customized for the project context to give sufficient confidence that the required level of human-centred quality will be achieved in each project. c) The extent of user or stakeholder involvement, evaluation and iteration needed to give sufficient confidence that emerging requirements for human-centred quality are identified. d) Human-centred design is integrated in the overall project plan, starting at the earliest stages, and taking account of the size and complexity of the interactive system and the resulting degree of decomposition of the design. e) The required resources (people, budgets, users, time) for HCD are known.
Base practices	**HCP.3.1.3.BP1: Identify the necessary HCD process outcomes** to be achieved through HCD to meet the human-centred quality objectives identified by HCP.3.1.1 and the benefits identified by HCP.3.1.2. [a][a] **HCP.3.1.3.BP2: Identify the HCD processes activities** to be carried out to achieve the HCD process outcomes. [a] **HCP.3.1.3.BP3: Identify which human factors data are required by the project.** [b] **HCP.3.1.3.BP4: Identify the method(s) used** to obtain the required data, taking account of the constraints imposed by the project and the project team's knowledge and understanding about ergonomics and user interface design. [b] **HCP.3.1.3.BP5: Identify the degree of user or stakeholder involvement, evaluation and iteration** required to achieve an acceptable degree of certainty of required human-centred quality. [c] **HCP.3.1.3.BP6: Plan the overall set of HCD activities** to be performed in order to provide human factors data, user requirements and evaluation results to guide the emerging design. [a, d] This can be carried out iteratively, for example in agile development. **HCP.3.1.3.BP7: Identify resources** (people, budgets, users, time) for HCD. [e]
Input work products	CIF.5 User requirements 6.18 Risk management report 8.04 Project requirements

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

[b] Human factors integration plan is included within 3.09 and 3.11.

[c] Verification and validation strategies include the evaluation plan.

Table 16 *(continued)*

Process ID	HCP.3.1.3
Output work products	2.01 Tailored system life cycle stage model [a] 2.02 Tailored system life cycle process model [b] 3.09 Project management plan [b, d][b] 3.11 Technical management plan [c][b] 3.20 Verification strategy [b, c][c] 3.22 Validation strategy [b, c][c] 6.13 Project resources and services report [e] 8.10 Project team requirements [e]
[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes. [b] Human factors integration plan is included within 3.09 and 3.11. [c] Verification and validation strategies include the evaluation plan.	

6.4.2.5 HCP.3.1.4 – Plan each HCD process activity

Table 17 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.3.1.4.

Table 17 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.3.1.4

Process ID	HCP.3.1.4
Process name	**Plan each HCD process activity**
Process purpose	To ensure that the work products produced by each HCD activity achieve the quality required for use by the project.
Process benefit	The HCD activities needed to achieve the required levels of human-centred quality are planned.
Process outcomes	a) The resources (people, budgets, time) required for each HCD activity are defined. b) The method(s) to be used to conduct each HCD process activity are selected and customized as appropriate. c) The necessary authorizations and approvals (e.g. ethical approval, works council agreement) are obtained. d) The work products to be delivered for each HCD process activity are defined. e) Each HCD activity is integrated in the overall project plan, allowing for any necessary iteration. f) Effective procedures are established for feedback and communication on HCD activities as they affect other design activities and trade-offs. g) Representative users of the system are available to participate in HCD activities where necessary. h) The composition of the design team includes sufficient diversity in expertise to collaborate over design and implementation trade-off decisions at appropriate times. i) Suitably qualified and experienced staff are available to carry out HCD activities.
[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.	

Table 17 *(continued)*

Process ID	HCP.3.1.4
Base practices	**HCP.3.1.4.BP1: Identify resources** required (in terms of time, delay and effort) and allow for sufficient investigation and iteration in order to meet human-centred quality objectives. [a][a] **HCP.3.1.4.BP2: Select method(s) for conducting each HCD activity.** [b] **HCP.3.1.4.BP3: Customize HCD procedures and customize associated tools and methods** as appropriate to provide sufficient and timely information to the project. [b, d] **HCP.3.1.4.BP4: Obtain necessary authorizations and approvals** (e.g. ethical approval). [c] **HCP.3.1.4.BP5: Define work products** to be produced by each HCD process activity (see Annex C). [d] **HCP.3.1.4.BP6: Define suitable formats for the work products** that result from the HCD process activities. [d] **HCP.3.1.4.BP7: Identify at which point of time each work product is needed in the project.** [e] **HCP.3.1.4.BP8: Plan each HCD process activity** in terms of resources (people with appropriate skills, budgets, time). [a, e] **HCP.3.1.4.BP9: Plan how feedback on the results of HCD activities will be communicated to other design activities and trade-offs, including an explanation and justification of any design recommendations.** [f] **HCP.3.1.4.BP10: Involve representative users** in the design and evaluation process as appropriate in order to collect user feedback for use in the design of organizational and technical systems. [g, h] **HCP.3.1.4.BP11: Assign competent staff** (internal or external) to conduct each HCD activity. [a, h, i]
Input work products	3.11 Technical management plan
Output work products	03.09 Project management plan [b, d, e, f] 03.10 Project acquisition plan [a, f, g, h] 03.13 Project quality plan [c, i]
[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.	

6.4.2.6 HCP.3.1.5 – Manage HCD process activities within the project

Table 18 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.3.1.5.

Table 18 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.3.1.5

Process ID	HCP.3.1.5
Process name	**Manage HCD process activities within the project**
Process purpose	To ensure that each HCD process activity is conducted as planned, specified work products achieve the required quality and are delivered at the right time for use in the project.
Process benefit	The HCD process activities needed to achieve the required levels of human-centred quality is carried out.
[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.	

Table 18 *(continued)*

Process ID	HCP.3.1.5
Process outcomes	a) Each HCD process activity is conducted as defined to deliver the specified work product. b) Required work products of HCD process activities are available when needed as input to the project. c) System work products (e.g. system architecture) are improved where necessary based on the results of HCD activities. d) The project plan and HCD activities are adjusted where necessary based on emergent data delivered by HCD activities. e) Work is conducted according to the organizational objectives for human-centred design and human-centred quality (see HCP.2)
Base practices	**HCP.3.1.5.BP1: Deliver agreed work products for each HCD process activity.** [a][a] **HCP.3.1.5.BP2: Monitor the accomplishment for each HCD activity.** [a, b] **HCP.3.1.5.BP3: Communicate work products of each completed HCD activity to stakeholders in project.** [b] **HCP.3.1.5.BP4: Identify where outputs of HCD activities point to needs for iteration and lead to changes in the overall project plan in order to continue to meet human-centred quality objectives.** [d] **HCP.3.1.5.BP5: Review the HCD activities within the project plan throughout the life of the project.** [c, e] **HCP.3.1.5.BP6: Ensure that HCD work products are appropriately acted on.** [d].
Input work products	3.11 Technical management plan
Output work products	06.04 System life cycle model review [d] 06.07 System life cycle process review [d] 06.11 Quality management report [a, c] 06.14 Project quality report [c, e] 06.15 Project progress report [b]

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

6.4.3 HCP.3.2 process sub-group: identify the context of use

6.4.3.1 Overall purpose and outcomes of HCP.3.2

The purpose of this set of processes is to identify the users of the interactive system and their characteristics, the goals and tasks, the resources used and the technical, physical, social, cultural and organizational environment of the interactive system (see ISO 9241-11), and to communicate this information. This can be for a current context of use or for an intended context of use (see ISO/IEC 25063).

The outcomes achieved by this set of processes are as follows:

— the characteristics of the actual or intended user groups, their goals and their tasks, including user interaction with other users and other interactive systems, are identified;

— the operational environment of the system, including the factors that affect the performance of users, is described in sufficient detail to support the design activities;

— information about the context of use and its implications is available throughout the life cycle of the interactive system.

NOTE Analysing, designing and evaluating human use of an interactive system can be addressed for a system in its current state, specified state and future state. A range of contexts of use can be considered, including the context of introducing or selling and the context of managing the system in operation.

These outcomes are achieved by performance of the processes addressed in Tables 19 and 20.

6.4.3.2 HCP.3.2.1 – Identify the intended user population and differentiate groups of users

Table 19 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.3.2.1.

Table 19 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.3.2.1

Process ID	HCP.3.2.1
Process name	**Identify the intended user population and differentiate groups of users**
Process purpose	To identify the intended user population and differentiate the groups of users taking account of the diversity of the population and describe the relevant characteristics of the identified user groups.
Process benefit	The intended user population is known and provides a basis for describing the context of use.
Process outcomes	a) User groups to be considered (for the interactive system to be designed or evaluated) are identified. b) Users with accessibility needs have been included to the greatest extent possible. c) The relevant characteristics (including the diversity of these characteristics) of each user group and their goals are described. d) User groups not to be considered (for the interactive system to be designed or evaluated) are identified.
Base practices	**HCP.3.2.1.BP1: Identify users** based on the intended target audience for the interactive system. [a][a] **HCP.3.2.1.BP2: Identify the goals** that the users have and the characteristics of the potential users based on information about existing users, information from databases and standards (for more information see ISO/IEC 25063 and ISO/TS 20282-2:2013, Annex C). [a, c] **HCP.3.2.1.BP3: Differentiate user groups** on the basis of shared goals, roles with respect to the interactive system under consideration and any relevant demographic characteristics (for more information see ISO/IEC 25063 and ISO/TS 20282-2:2013, Annex C). [c] **HCP.3.2.1.BP4: Describe the attributes of each user group** relevant for the interactive system to be designed or evaluated, including any needs for accessibility. (See, for example, ISO/IEC 29138-1 and ISO/TR 22411.) [c] **HCP.3.2.1.BP5: Include potential users with accessibility needs** to the greatest extent possible, including all potential users covered by any legislation. [b] **HCP.3.2.1.BP6: Identify any types of users** who are not included in the intended context of use, and the reasons why they are not included. [d]
Input work products	08.04 Project requirements 08.12 Stakeholder requirements
Output work products	02.07 Stakeholder's profile [a, b][b] CIF.3 Context of use [c, d]

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

[b] 02.07 includes user group profiles, which is a synonym for a target audience description (TAD) and personas.

6.4.3.3 HCP.3.2.2 – Identify other relevant aspects of the context of use and reported issues

Table 20 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.3.2.2.

Table 20 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.3.2.2

Process ID	HCP.3.2.2
Process name	**Identify other relevant aspects of the context of use and reported issues**
Process purpose	To understand and determine the goals and tasks and ensure that sufficient information about the context of use is available to support human-centred design of the interactive system.
Process benefit	The context of use is described.
Process outcomes	a) The goals and related tasks, resources and equipment (hardware and software), social and organizational environment and physical environment for all user groups to be supported are identified and clearly communicated to all project members in sufficient detail to support the design activities. b) Risks associated with the achievement of goals and execution of tasks are known. c) Sufficient information is obtained to identify implied needs and to support design or evaluation.
Base practices	**HCP.3.2.2.BP1: Agree on the scope for context of use analysis** (e.g. tasks and environments to be focused on) based on the purpose of the interactive system to be designed or evaluated, the human-centred quality objectives and the needed level of detail (e.g. the extent to which users' goals are decomposed). [a][a] **HCP.3.2.2.BP2: Select and use appropriate method(s)** for collecting and describing context of use information (e.g. context interviews, observations, user self-reports). [a] **HCP.3.2.2.BP3: Identify and, where necessary, research all relevant aspects of the context(s) of use for each user group**: including goals and related outcomes, tasks, system interdependencies, resources and equipment (hardware and software), technical environment (including development environment for the system to be built or advanced), social and organizational environment, physical environment, management structure, communications and organizational practices or legislation. (For more details, see ISO/IEC 25063.) [a, b] **HCP.3.2.2.BP4: Carry out task analysis** in order to understand identified tasks and the relationships between them. [a] **HCP.3.2.2.BP5: Assess risks associated with using the interactive system**, for example if tasks are performed incorrectly. [b] **HCP.3.2.2.BP6: Describe the context of use for each intended or actual user group** in a suitable format and sufficient detail for later use (e.g. user needs analysis, user requirements specification and evaluation). [a] **HCP.3.2.2.BP7: Create and evaluate design concepts** to obtain a better understanding of the context of use. [c] **HCP.3.2.2.BP8: Decide whether the quality of information is complete and in sufficient detail or whether further investigation is required.** [c] **HCP.3.2.2.BP9: Communicate information about the context of use** to relevant project stakeholders. [a, b, c]
Input work products	08.12 Stakeholder requirements 08.18 Human-equipment interface requirements (for existing systems)
Output work products	CIF.3 Context of use description [a, b, c]

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

6.4.4 HCP.3.3 process sub-group: establish the user requirements

6.4.4.1 Overall purpose and outcomes of HCP.3.3

The purpose of this set of processes is to ensure that a comprehensive set of valid and verifiable user requirements relevant for the context of use are specified for the interactive system to be developed.

The outcomes achieved by this set of processes are as follows:

— the user needs are identified;

— the user requirements are derived and specified, taking account of both user needs (HCP.3.3.1) and high-level human-centred quality objectives (HCP.3.1.1);

— the stakeholder requirements that have impact on the user requirements are identified.

These outcomes are achieved by performance of the processes addressed in Tables 21 to 23.

NOTE 1 User-system interaction requirements and the associated use-related quality requirements (in HCP.3.3.2) are based on the subset of user needs (in HCP.3.3.1) that the design solution is intended to support. In simple cases, the specification of user requirements emerges directly from the identification of user needs.

NOTE 2 These processes can be performed iteratively to achieve an adequate depth of understanding of the users' requirements for complex or ill-defined systems.

6.4.4.2 HCP.3.3.1 – Identify the user needs

Table 21 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.3.3.1.

Table 21 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.3.3.1

Process ID	HCP.3.3.1
Process name	**Identify the user needs**
Process purpose	To provide the basis for deriving a comprehensive set of valid user requirements.
Process benefit	The user needs relating to human-centred quality are identified.
Process outcomes	a) The user needs are comprehensively described and documented. b) Opportunities for new solutions to user needs are identified. c) Existing problems, deficiencies and workarounds are identified. d) Stakeholders are informed about user needs to be used for deriving user requirements. e) There is sufficient information to derive user requirements that adequately satisfy the user needs.
[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.	

Table 21 *(continued)*

Process ID	HCP.3.3.1
Base practices	**HCP.3.3.1.BP1: Analyse all data within the context of use description for user needs** (i.e. prerequisites necessary for users to achieve the intended outcomes), taking account of user needs for accessibility (see ISO/IEC 29138-1), usability, user experience and risks of harm arising from use. User needs include needs for information, enjoyment and needs related to the physical and/or social environment (see ISO/IEC 25064 for more details). User needs are stated independently of any solution. [a, d][a] EXAMPLES i) Renting a car: a car driver with an injured foot needs to have a rental car with automatic gears in order to be able to drive the car. ii) Boiling eggs for breakfast: the person preparing breakfast for the family needs to know each family member's preference for their boiled egg (soft, medium, hard) in order to supply each boiled egg according to the preference of each family member. iii) Monitoring the health state of each patient at an intensive care unit: the health-care professional in an intensive care unit needs to know whether the vital parameters of each intensive care patient are deteriorating in order to take corrective action. iv) Waking up early in the morning: a person who uses an alarm clock does not want to get startled by its sound. **HCP.3.3.1.BP2: Identify needs related to aspects of user experience**, including (where appropriate): organizational impacts, user documentation, online help, support and maintenance (including help desks and customer contact points), training, long-term use, the user's aesthetic experience of physical design, product packaging (including the "out-of-box experience"), the user experience of previous or other systems and issues such as branding and advertising. [a, b] **HCP.3.3.1.BP3: Consult relevant stakeholders** (e.g. representative users, subject matter experts, managers) to obtain a correct and complete set of user needs, including those derived from organizational and management needs. [a, d] **HCP.3.3.1.BP4: Identify opportunities for new solutions to user needs.** [b] **HCP.3.3.1.BP5: Identify existing problems, deficiencies and workarounds related to systems in use.** [c] **HCP.3.3.1.BP6: State each user need as an outcome to be achieved by the user** (what is to be achieved, rather than how) and the circumstances in which users have these needs. [d] **HCP.3.3.1.BP7: Communicate the identified needs and the context of use** that they relate to (including any constraints imposed by the context of use) to all relevant project stakeholders. [d]
Input work products	CIF.3 Context of use description 07.10 Operation request
Output work products	CIF.4 User needs report [a, e] 08.13 Stakeholder requirements constraints on solution [c, d, e]

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

6.4.4.3 HCP.3.3.2 Specify the user requirements

Table 22 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.3.3.2.

Table 22 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.3.3.2

Process ID	**HCP.3.3.2**
Process name	**Specify the user requirements**
Process purpose	To specify a set of user requirements that provide the basis for designing system solutions that satisfy the user needs and address each high-level human-centred quality objective identified in HCP.3.1.1.
Process benefit	A clear statement of user requirements for the interactive system that takes account of the users' perspective, providing information on the characteristics of the context of use and the needs of the users, is available to the project.
Process outcomes	a) The intended contexts of use for design are specified to clearly define the conditions under which the requirements apply (i.e. user groups to be supported, goals and tasks to be supported, resources and environments to be supported). b) User requirements are specified based on the human-centred quality objectives, the identified user needs and guidance from ergonomics. These include: i) use-related quality requirements, which can be used as acceptance criteria if required; ii) user-system interaction requirements for the necessary information, choices and inputs that users require so that they can achieve the intended outcomes. c) The user requirements are structured and prioritized in a form that can be used by the project team. d) The user requirements take account of the results of user-centred evaluation of either the user requirements or design concepts. e) Any constraints that limit the freedom of design and implementation to satisfy the user requirements of the interactive system are stated. f) Emergent organizational requirements that are critical to the success of the system are derived from user requirements. g) If user requirements cannot be implemented immediately, a human-centred quality roadmap (e.g. user experience roadmap) is used to help prioritize user requirements to be implemented over time. h) The user requirements are communicated to the project team.
Base practices	**HCP.3.3.2.BP1: Specify the contexts of use** (e.g. sets of user types, goals, hardware and software usage environments) in which the interactive system will be used and for which the system is required to achieve acceptable levels of human-centred quality. [a][a] **HCP.3.3.2.BP2: Analyse the human-centred quality objectives, user needs and relevant ergonomic guidance** to establish the user requirements. [b] **HCP.3.3.2.BP3: Specify use-related quality requirements** as required to meet criteria for human-centred quality. [b] EXAMPLES

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

[b] It is possible that this work product will be changed by this process.

[c] Context of use for design.

Table 22 *(continued)*

Process ID	HCP.3.3.2
	— The average time that air passengers entering the United States take to pass through immigration (during specified hours) shall be no more than half the average time taken currently, while maintaining currently specified levels of security and safety in screening arrivals. — 80 % of all potential users of the ticket machine shall prefer the use of the ticket machine to the use of the ticket counter. — With the ticket machine, 95 % of users shall be able to buy the cheapest ticket to a location within 30 s. — The percentage of use errors made by users that can cause harm (under specified conditions) shall not be greater than 1 %. — The mean rating given by user group X for the company's reputation as the market leader for quality and innovation shall not decrease after the users read advertising material for the new product. Quality requirements can be used to guide design and development, even if they are not subsequently used as acceptance criteria. **HCP.3.3.2.BP4: Specify user-system interaction requirements** based on human-centred quality objectives, user needs and ergonomic guidance. [b, e] User-system interaction requirements include: information to be detected by users, choices and inputs that users make with the interactive system, and the users' perceptions and responses and any constraints that limit the freedom of design and implementation. EXAMPLES — Communicating with the bank: the user is able to select a preferred means of communication with their bank < visit, telephone or online > — Renting a car (using a car rental website): the user is able to enter the desired date and time of rental. — Monitoring the health state of patients at an intensive care unit (using a mobile medical app): the user is able to immediately detect whether the heart rate of any patient is decreasing. — Accessing health records: the user is only able to access health records for which they have the authorization. **HCP.3.3.2.BP5: Incorporate relevant guidance from ergonomics,** including user interface and interaction design guidance, standards and guidelines (including ISO 9241-110). [b] This can be achieved by using a style guide that is based on existing standards and other good practice. **HCP.3.3.2.BP6: Identify whether different user groups have different requirements.** [a] **HCP.3.3.2.BP7: Structure the user requirements** in a form that can be used by the project team. [c] EXAMPLE User-system interaction requirements are structured by each corresponding task to be supported by the system.

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

[b] It is possible that this work product will be changed by this process.

[c] Context of use for design.

Table 22 *(continued)*

Process ID	HCP.3.3.2
	HCP.3.3.2.BP8: Identify and resolve potential conflicts among the user requirements. [c] **HCP.3.3.2.BP9: Prioritize each user requirement** (from the perspective of the users) with representatives of the user groups. [c, d] **HCP.3.3.2.BP10: Evaluate the user requirements or design concepts** (e.g. using low-fidelity prototypes) in order to refine the user requirements (HCP.3.5.1). [d] **HCP.3.3.2.BP11: Identify any constraints** in terms of factors known to limit the freedom of design and implementation to satisfy the user requirements for the interactive system to be developed. [e] **HCP.3.3.2.BP12: Identify emergent organizational requirements** that need to be implemented to enable the implementation of user requirements. [f] EXAMPLE User requirement: "The user of the warehouse system is able to assign a suitable ramp for each arriving truck". Emergent organizational requirement: "The site control must categorize each type of truck as it arrives." **HCP.3.3.2.BP13: If all user requirements cannot be implemented immediately, prioritize user requirements** in a sequence of time to deliver appropriate capabilities of the system for achieving optimal human-centred quality over time. [g] **HCP.3.3.2.BP14: Communicate the user requirements** specification to all relevant project stakeholders. [h]
Input work products	CIF.3 Context of use description[b] CIF.4 User needs report
Output work products	CIF.3 Context of use description [a][b,c] CIF.5 User requirements specification [b, c, e, g, h] 06.21 Stakeholder requirements report [a, d, e, f, g, h] 08.16 System technical measures specification [b, c]

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

[b] It is possible that this work product will be changed by this process.

[c] Context of use for design.

6.4.4.4 HCP.3.3.3 Negotiate and prioritize the user requirements in the context of a project

Table 23 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.3.3.3.

Table 23 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.3.3.3

Process ID	HCP.3.3.3
Process name	**Negotiate and prioritize the user requirements in the context of a project**
Process purpose	To ensure that potential conflicts between user requirements, stakeholder requirements and other project requirements are resolved.
Process benefit	User requirements are taken into account in the specification of the interactive system.

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

Table 23 *(continued)*

Process ID	**HCP.3.3.3**
Process outcomes	a) Relationships between user requirements and other requirements are known. b) Integration requirements with other systems are accepted in order to deliver unified user experience. c) Implementation priorities are assigned to all user requirements. d) The feasibility of meeting the high-priority user requirements forms part of feasibility studies for technical solutions. e) An accepted and consistent set of user requirements can be used in the definition of system requirements. f) System capabilities are delivered in an appropriate sequence across multiple releases to achieve optimal human-centred quality for each release.
Base practices	**HCP.3.3.3.BP1: Identify dependencies and relationships between user requirements and other requirements**, including other stakeholder and project requirements (such as buy or build). [a][a] **HCP.3.3.3.BP2: Identify the interdependencies and integration requirements of the system with other systems** in terms of user interface, business process or workflow, data, architecture, capabilities, etc. [b] **HCP.3.3.3.BP3: Agree on a scheme for implementation priorities**, taking account of the potential benefits and harm for project stakeholders for whom the success of the system is critical, identified in HCP.3.1.2. [c] **HCP.3.3.3.BP4: Identify the risks to human-centred quality** associated with not implementing each user requirement. [c] **HCP.3.3.3.BP5: Assign an implementation priority to each user requirement.** [c] **HCP.3.3.3.BP6: Identify the feasibility** of, and costs associated with, implementing high-priority user requirements. [d] **HCP.3.3.3.BP7: Agree on the implementation of user requirements** (involving user groups and project stakeholders). [e] **HCP.3.3.3.BP8: Document the rationales for rejected user requirements** so that these can be understood in the future. [e] **HCP.3.3.3.BP9: Deliver system capabilities in an appropriate sequence across multiple releases.** [f]
Input work products	CIF.3 Context of use description CIF.5 User requirements specification 08.13 Stakeholder requirements constraints on solution
Output work products	05.10 Stakeholder requirements record [a, b, c] 06.22 System requirements report [c, e] 08.14 System requirements [e, f] 08.15 System requirements constraints on solution [d, e]

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

6.4.5 HCP.3.4 process sub-group: design solutions that meet user requirements

6.4.5.1 Purpose and outcomes of HCP.3.4

The purpose of this set of processes is to incorporate user requirements and human factors data into potential design solutions that can be evaluated to provide the basis for modifying the design solution to eliminate defects that affect human-centred quality.

NOTE 1 Designs can be generated in conceptual form from the earliest stages of the project. They can be used to help identify and refine user requirements and to assess the feasibility and acceptability of implementing them.

The outcomes achieved by this set of processes are as follows:

— the design of the architecture of the interactive system takes account of user requirements;

NOTE 2 This architecture can either be an explicit outcome or can be the implicit result of other outcomes.

— the design of the solution takes published human factors data into account;

— one or more design solutions are available that take account of the need to:

  — allow interaction according to the sequence of activities and tasks to be supported;

  — meet the accepted user requirements;

  — adhere to user interface design guidance;

  — be in a form that can be evaluated by users;

  — provide a basis for assessing the costs for implementation of a solution that meets user requirements.

These outcomes are achieved by performance of the processes addressed in Tables 24 and 25.

NOTE 3 These processes and activities are performed with increasing rigour in the concept, development and implementation stages of the system life cycle.

6.4.5.2 HCP.3.4.1 – Specify the user-system interaction

Table 24 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.3.4.1.

Table 24 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.3.4.1

Process ID	**HCP.3.4.1**
Process name	**Specify the user-system interaction**
Process purpose	To ensure that all necessary interactions of the users during task completion are identified and the corresponding user requirements can be implemented according to the task model for each task
Process benefit	The user-system interaction is designed to address the high-level human-centred quality objectives.

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

Table 24 *(continued)*

Process ID	HCP.3.4.1
Process outcomes	a) Appropriate modes of user-system interactions are determined across modalities. b) The overall task model to be supported is agreed upon, including strategies for mitigation of harm from use. c) The interaction between user and system is specified from the user's perspective. d) An appropriate allocation of function between users and technology is derived, taking account of the users' strengths, limitations, preferences and expectations. e) Action-guiding information to be supplied during task completion is identified. f) The interaction objects for the interaction between user and system can be derived. g) User interface guidance for aesthetic design is applied. h) The necessary system functions to enable the interaction between user and system can be derived.
Base practices	**HCP.3.4.1.BP1: Analyse each user requirement** related to information and control to be supplied by the interactive systems, taking into account tasks, function allocation, human performance and workload across modalities (e.g. visual, auditory, tactile) to determine the best interactions to be implemented in design. [a][a] **HCP.3.4.1.BP2: Identify and specify each task** to be supported with the system, based on the task analysis (as part of the context of use analysis), the specified user requirements and potential for use error. [b] **HCP.3.4.1.BP3: Create a task model** by decomposing each task into subtasks as a set of activities meaningful to the intended user. [c] **HCP.3.4.1.BP4: Describe for each task the precondition(s) and the intended outcome to be achieved.** [c] **HCP.3.4.1.BP5: Define the rules for allocating actions between user and system** as a meaningful set of tasks that will optimize human-centred quality. [d] **HCP.3.4.1.BP6: Specify which actions are allocated to the user and which actions and reactions (including action-guiding information to the user) are provided by the system,** taking account of the users' strengths, limitations, preferences and expectations, and involving representative users when possible. [d, e, f] **HCP.3.4.1.BP7: Identify and apply user interface design guidance** for the aesthetic aspects of the design (including physical, tactile, visual, auditory aspects). [g] **HCP.3.4.1.BP8: Decide whether the interaction specification is adequate for producing the design solution or whether further investigation is required.** [f, h]
Input work products	CIF.3 Context of use 08.13 Constraints of stakeholder requirements on solution 08.14 System requirements 08.15 Constraints of system requirements on solution 08.20 Implementation constraints on solution 08.26 Transition constraints on solution 08.28 Validation constraints on solution 08.30 Maintenance constraints on solution 08.32 Disposal constraints on solution

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

Table 24 *(continued)*

Process ID	HCP.3.4.1
Output work products	CIF.7 User interaction specification [b, d, e] 02.08 System functional model [c, f] 08.18 Human-equipment interface requirements [a, d, g] 05.11 System requirements traceability [a, f]
[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.	

6.4.5.3 HCP.3.4.2 – Produce and refine user interface design solutions

Table 25 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.3.4.2.

Table 25 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.3.4.2

Process ID	HCP.3.4.2
Process name	**Produce and refine user interface design solutions**
Process purpose	To produce and iteratively evaluate user interface design solutions from a user perspective to ensure that user requirements have been met.[a]
Process benefit	User interfaces are designed that satisfy the user requirements and take account of the human-centred quality objectives. The iterative design of the user interface supports early identification and economical resolution of defects or other issues that cause human-centred quality problems.
Process outcomes	a) The potential benefits of innovative solutions for the user interface design have been considered. b) User interface technology is selected that supports the identified user-system interaction. c) A user interface design solution is available that enables completion of one or more tasks by the intended range of users. d) The user's interaction with the user interface design solution has been evaluated for acceptable human-centred quality before technical implementation. e) Decisions are made on how to deal with identified problems related to the human-centred quality for the redesign of the interactive system and/or, when necessary, alternatives such as training, help or user support are to be provided. f) Necessary corrective actions are initiated if the user interface design solution does not sufficiently meet the user requirements. g) The development team has a basis for the technical implementation of the system (whether a new release of an existing system, a customization of a procured system or components, or development of a new system).
[a] For an existing or procured system, if any gaps in meeting the human-centred quality objectives are identified, this process can be used to decide how it can be configured or customized to produce the optimal user interface design. [b] The reference in the brackets indicates the relationship of the base practice to the process outcomes. [c] Technological possibilities are covered in 08.17: System interface requirements. Refinement includes development of low fidelity prototypes.	

Table 25 *(continued)*

Process ID	HCP.3.4.2
Base practices	**HCP.3.4.2.BP1: Explore the potential benefits of using an innovative solution** (the use of creative design and/or new technologies). [a][b] **HCP.3.4.2.BP2: Select the appropriate user interface technology** for the system to support the identified user-system interaction, in conjunction with other project stakeholders. [b] **HCP.3.4.2.BP3: Create an interface design solution** that implements one or more user's requirements that support tasks defined in the context of use description. [c] **HCP.3.4.2.BP4: If providing accessibility, decide whether to use a single design for all approaches or whether to support individualization to specific user needs.** [c] **HCP.3.4.2.BP5: Identify appropriate interaction styles** (dialogue techniques). [c] **HCP.3.4.2.BP6: Derive the necessary interaction objects, the sequence and timing (dynamics) of the interaction and the navigation structure.** [c] **HCP.3.4.2.BP7: Design the information architecture** to allow efficient access to interaction objects. [c] **HCP.3.4.2.BP8: Identify and apply appropriate guidance** for the design of the user interface and interaction of both hardware and software of the user interface according to the target platform. [c] **HCP.3.4.2.BP9: Construct testable user interface design alternatives** with a level of detail and realism that is appropriate to the issues that need to be investigated. [c] The user interface design solution can be a prototype that is as simple as a sketch or static mock-up or as complicated as a fully functioning interactive system with more or less complete functionality. **HCP.3.4.2.BP10: Evaluate design with users** in order to identify previously unidentified context information, identify emergent needs and refine the user requirements, identify design improvements and ensure that any required objectives for human-centred quality have been achieved. (HCP 3.5) [d] **HCP.3.4.2.BP11: Iteratively adapt the concept** based on the findings of user-centred evaluation until an acceptable cost-effective solution is obtained. [e, f] i) Take account of the costs and benefits of proposed changes when deciding what will be modified. ii) Decide (using HCP.3.5) if the user interface design solution sufficiently meets the user requirements. **HCP.3.4.2.BP12: Communicate the acceptable solution** to the development team, based on the user requirements and tasks to be supported by the solution. [g] For a ready-to-use system (where the design is not under control of the project), evaluate the system (HCP.3.5) to determine whether it adequately meets the requirements established in HCP.3.4.1.

[a] For an existing or procured system, if any gaps in meeting the human-centred quality objectives are identified, this process can be used to decide how it can be configured or customized to produce the optimal user interface design.

[b] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

[c] Technological possibilities are covered in 08.17: System interface requirements. Refinement includes development of low fidelity prototypes.

Table 25 *(continued)*

Process ID	HCP.3.4.2
Input work products	CIF.7 User interaction specification CIF.6 Evaluation report 08.13 Stakeholder requirements constraints on solution 08.15 System requirements constraints on solution 08.18 Human-equipment interface requirements 08.20 Implementation constraints on solution 08.26 Transition constraints on solution 08.28 Validation constraints on solution 08.30 Maintenance constraints on solution 08.32 Disposal constraints on solution 03.11 Technical management plan
Output work products	CIF.8 User interface specification [a, b, c, d, g] 02.09 Architectural design description [c, e, g] 08.17 System interface requirements [b][c]

[a] For an existing or procured system, if any gaps in meeting the human-centred quality objectives are identified, this process can be used to decide how it can be configured or customized to produce the optimal user interface design.

[b] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

[c] Technological possibilities are covered in 08.17: System interface requirements. Refinement includes development of low fidelity prototypes.

6.4.6 HCP.3.5 process sub-group: user-centred evaluation

6.4.6.1 Purpose and outcomes of HCP.3.5

The purpose of this set of processes is to ensure that proposed and actual designs are evaluated and the feedback is used to shape and improve the design throughout the life cycle, specifically in relation to HCPs 3.2, 3.3, 3.4, 4.1 and 4.3. The set of processes can also be used to evaluate whether procured systems or components are acceptable and to make comparisons between competitor products.

The outcomes achieved by this set of processes are as follows:

— the design solutions that are most likely to provide human-centred quality are identified and refined;

— defects that affect human-centred quality are identified before implementation;

— overlooked user needs and requirements are identified before the system is implemented;

— incompleteness and misinterpretations in the user interaction specification and user interface specification are identified before the system is implemented;

— the degree of conformity with user requirements of the system intended for release is known;

— usability problems during operation are identified.

These outcomes are achieved by performance of the processes addressed in Tables 26 to 28.

6.4.6.2 HCP.3.5.1 – Plan for evaluation throughout the project

Table 26 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.3.5.1.

Table 26 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.3.5.1

Process ID	**HCP.3.5.1**
Process name	**Plan for evaluation throughout the project**
Process purpose	To ensure appropriate user-centred feedback is available on design concepts and prototypes and enable use of the results for improving the interactive system (or the given representation of the system) at appropriate stages of the life cycle.
Process benefit	Potential human-centred quality problems are identified, and the user requirements related to and acceptance criteria for human-centred quality objectives established in HCP.3.3.2 are assessed.
Process outcomes	a) Evaluation to achieve the following purposes is planned as part of the referenced processes: i) Evaluation of design concepts in order to better understand the context of use (HCP.3.2.2) and to refine the user requirements for the interactive system (HCP.3.3.2). ii) Evaluation of prototypes in order to check that ergonomic guidance has been followed (HCP.3.4.2). iii) Evaluation of prototypes in order to improve the design (HCP.3.4.2). iv) Evaluation of prototypes to check that the user, other stakeholder and organizational requirements have been met (HCP.3.4.2). v) Evaluation of the interactive system in use in order to ensure that it continues to satisfy organizational and user needs (HCP.4.1, HCP.4.3). vi) Evaluation in order to identify usability problems (HCP.3.4.2, HCP.4.1, HCP.4.3). vii) Evaluation in order to measure aspects of human-centred quality (e.g. using a method such as that specified in ISO/TS 20282-2) (HCP.3.4.2, HCP.4.1, HCP.4.3). b) The aspects of human-centred quality to be evaluated are decided. c) Appropriate methods and degree of user involvement to be employed for evaluation are agreed on (ISO/IEC 25066 describes different types of evaluation). d) The work products to be delivered for each evaluation activity are specified. e) Sufficient time is allocated for communication among design team participants, decisions about changes, and for reconciling potential conflicts and trade-offs regarding human-system issues. f) Iterative evaluation is carried out if necessary.
Base practices	**HCP.3.5.1.BP1: Identify the object of evaluation** at appropriate stages of the project and which of the types of evaluations listed in process outcome a) are needed. [a][a] **HCP.3.5.1.BP2: Identify which aspects of human-centred quality are to be evaluated**, that can include: [b].

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

Table 26 *(continued)*

Process ID	HCP.3.5.1
	i) defects that potentially affect human-centred quality (resulting in unacceptable usability, accessibility, user experience and/or avoidance of harm from use); ii) the extent to which users can achieve their functional, cognitive, affective or psychomotor goals; iii) acceptable use of resources, including time, money and mental and physical effort; iv) acceptable risks of unacceptable consequences (including negative personal, business or health and safety consequences); v) trust; vi) the extent to which usability is achieved in each of the specified context of use; vii) the extent to which accessibility is achieved (including evaluation of accessibility for user groups with specific disabilities); viii) user engagement, frustration and/or pleasure; ix) user satisfaction with any of the above. **HCP.3.5.1.BP3: Decide which methods to use, and degree of user involvement for each type of evaluation and object of evaluation.** (See ISO/IEC 25066 for more details.) [c, d] **HCP.3.5.1.BP4: Allocate resources,** including competent staff (internal or external) both for obtaining early feedback to improve the system, product or service and later for determining if requirements have been satisfied [a]. **HCP.3.5.1.BP5: Plan the scope of later summative evaluation** to assess whether the interactive system meets requirements, depending on the extent of the risks associated with not meeting requirements. [a] **HCP.3.5.1.BP6: Plan degree of iteration** in terms of number of evaluation cycles to be expected, taking account of project risks. [g] **HCP.3.5.1.BP7: Plan how evaluation results will be** communicated to all relevant stakeholders and how decisions on changes to the evaluated system will be made. [e, f]
Input work product	03.20 Verification strategy 03.22 Validation strategy
Output work products	04.06 Verification procedure [a, c, d, e, f] 04.08 Validation procedure [a, c, d, e, f] 08.25 Verification enabling system requirement [b, d, e] 08.29 Validation enabling system requirements [b, d, e] CIF.6 [a, b, c]

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

6.4.6.3 HCP.3.5.2 – Plan each evaluation (what to evaluate and how)

Table 27 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.3.5.2.

Table 27 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP3.5.2

Process ID	**HCP.3.5.2**
Process name	**Plan each evaluation (what to evaluate and how)**
Process purpose	To identify the most appropriate evaluation method(s) to use and plan how the results will be used.
Process benefit	The evaluation method(s) that are needed to identify potential defects that affect human-centred quality and to ensure that user requirements can be evaluated are defined appropriately.
Process outcomes	a) The objectives of the evaluation are identified. b) The methods and work products for conducting the evaluation are agreed. c) The inspection-based or user-based evaluation is prepared appropriately. i) All relevant aspects of human-centred quality are included. ii) The evaluation is based on a realistic context of use. iii) The evaluation is scheduled. d) Stakeholders are involved as appropriate.
Base practices	**HCP.3.5.2.BP1: Identify the intended outcomes of the specific evaluation**, which can include: [a][a] i) identifying the aspects of human-centred quality to be evaluated; ii) identifying defects that affect human-centred quality; iii) identifying recommendations for improving the human-centred quality of the object of evaluation; iv) identifying additional user requirements; v) obtaining a baseline for human-centred quality for the whole system, product or service; vi) comparing the human-centred quality of different systems, products or services; vii) reporting conformity with specified criteria. **HCP.3.5.2.BP2: Agree on the user group(s)** to be considered for the evaluation (HCP.3.2.1). [c] For user-based evaluation, participants have the capabilities, characteristics and relevant previous experience that reflect the range of users for whom the system is being designed. **HCP.3.5.2.BP3: Select the context of use** to be used for evaluation that adequately represents the real context of use. [c] If tasks are used, then tasks are specified based on the users' intended objectives. **HCP.3.5.2.BP4: Agree appropriate methods for the inspection-based or user-based evaluation and the evaluation schedule.** [b] When prototypes are being tested, users provide feedback while carrying out tasks rather than just commenting on demonstrations that provide a preview of the design. **HCP.3.5.2.BP5: Ensure that the system is fit for evaluation and all resources are available** (e.g. evaluators, users, test system, test data and test task descriptions). [c] **HCP.3.5.2.BP6: Plan the involvement of stakeholders as appropriate.** [d] **HCP.3.5.2.BP7: Plan the communication of evaluation outcomes**. [d]

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

[b] Test cases are included in verification and validation procedures (e.g. scenarios).

Table 27 *(continued)*

Process ID	HCP.3.5.2
Input work products	CIF.5 User requirements specification 03.20 Verification strategy 03.22 Validation strategy
Output work products	04.06 Verification procedure [a, b, c][b] 04.08 Validation procedure [a, b, c, d][b] 08.28 Validation constraints on solution [b]
[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes. [b] Test cases are included in verification and validation procedures (e.g. scenarios).	

6.4.6.4 HCP.3.5.3 – Carry out each evaluation

Table 28 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.3.5.3.

Table 28 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.3.5.3

Process ID	HCP.3.5.3
Process name	**Carry out each evaluation**
Process purpose	To obtain the information needed to achieve the evaluation objectives identified in HCP.3.5.2.
Process benefit	Potential or actual problems related to human-centred quality are identified.
Process outcomes	a) Results (that include identified usability problems and/or measures of human-centred quality) are obtained for the evaluation objectives and using the methods identified in HCP.3.5.2. b) Identified issues are prioritized from a user perspective with proposed solutions. c) The evaluation results are provided in the form of the work products identified in HCP.3.5.2 b) and communicated to all relevant stakeholders involved in the process.
Base practices	**HCP.3.5.3.BP1: Conduct evaluation** according to agreed-upon methods. [a][a] **HCP.3.5.3.BP2: Carry out sufficiently comprehensive evaluation** to provide meaningful results for the system as a whole. [a] **HCP.3.5.3.BP3: Analyse the evaluation results**, which can include the following: [a]
[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.	

Table 28 *(continued)*

Process ID	HCP.3.5.3
	i) whether or not the pre-established human-centred quality objectives (HCP.3.1.1) defined as part of the project success criteria are met; ii) defects that affect human-centred quality are identified; iii) recommendations are made for improving the design of the object of evaluation to resolve defects that affect human-centred quality; iv) failures to meet user requirements are identified; v) overlooked and emergent user requirements are identified; vi) incompleteness and misinterpretations in the user interaction specification and user interface specification are identified; vii) quantitative information such as a baseline is obtained for human-centred quality for the whole system, product or service; viii) results that enable the human-centred quality of different systems, products or services to be compared. **HCP.3.5.3.BP4: Prioritize any issues from a user perspective and propose solutions.** [b] **HCP.3.5.3.BP5: Document the evaluation results** in the form of the agreed-upon work product so that they can be used effectively by all relevant stakeholders in the process. [c] **HCP.3.5.3.BP6: Communicate the evaluation results** to all relevant stakeholders involved in the process. [c]
Input work products	04.06 Verification procedure [a, b, c] 04.08 Validation procedure [a, b, c]
Output work products	CIF.6 Evaluation report [a][b] 05.09 Stakeholder requirements traceability [b] 06.26 Verification report [b, c] 06.28 Validation report [b, c] See ISO/IEC 25062 and ISO/IEC 25066 for details of reporting. Result of evaluation depends on purpose.
[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.	

6.5 HCP.4 process group: introduction, operation and end of life of a system

6.5.1 Purpose and outcomes of HCP.4

The main audiences for this set of processes are operations managers, service and support managers, educators and trainers, and senior HCD professionals responsible for the operational human-centred quality of interactive systems. The types of risks addressed include operational risks, human-system issues in the service and the quality of the service. For vendors, developers and those introducing interactive systems, particularly for use on a personal basis, rather than within organizations, only a subset of the outcomes and activities that are within their responsibility are relevant.

The purpose of this set of processes is to identify unsatisfied needs and unsatisfactory system attributes during introduction, support, maintenance and disposal or retirement of the system in order to identify opportunities and risks and continuously meet stakeholder and user requirements.

NOTE 1 The relevant activities in these processes are instantiated from the beginning of a project in order to define requirements for the introduction and use of the system (see ISO 9241-220:2019, 7.3).

The outcomes achieved by this set of processes are as follows:

— the transition into operation is managed;

— feedback on the operation is obtained;

— the operation of the system is supported;

— changes in context of use and user needs are identified;

— necessary changes in the system are identified and implemented;

— disposal, retirement and/or replacement are achieved with minimal impact on quality of service;

— the system meets user needs throughout its life cycle, including end of life.

NOTE 2 In some cases, performance of these processes uses relevant HCP.3 processes.

These outcomes are achieved by performance of the processes addressed in Tables 29 to 32.

6.5.2 HCP.4.1 – Introducing the system

Table 29 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.4.1.

Table 29 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.4.1

Process ID	**HCP.4.1**
Process name	**Introducing the system**
Process purpose	To communicate HCD-relevant attributes of the system and to manage change in order to ensure that human-centred quality is addressed in the implementation, validation and introduction of an interactive system into its intended environment.
Process benefit	The factors that affect human-centred quality during introduction of a system are known, documented and addressed.
[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.	
[b] It is possible that this work product will be changed by this process.	

Table 29 *(continued)*

Process ID	HCP.4.1
Process outcomes	a) The needs of the users and stakeholders related to introduction and adoption of the system are known by the project. b) User requirements for enabling systems and services needed for implementation are identified and implemented. c) The system can be adapted (as appropriate) to meet the requirements of individual implementations. d) The system takes sufficient account of applicable legal requirements for use in the installation location. e) The implementation plan addresses user and stakeholder needs. f) Users and other stakeholders are aware of and accept the changes and innovations that are intended to achieve the required level of human-centred quality. g) User help and training are provided and used when needed. h) User support is provided. i) A smooth transition to new job designs and/or teamwork arrangements is achieved. j) First-use problems are minimized. k) Human-system issues identified when the system is first used are resolved. l) The interactive system meets user requirements in the actual context of use.
Base practices	**HCP.4.1.BP1: Determine and communicate impact of introduction on users and stakeholders.** [a][a] **HCP.4.1.BP2: Identify user requirements** for any enabling systems or services required for implementation. [b] **HCP.4.1.BP3: Identify applicable legal requirements** for use of the system in the installation location (e.g. workplace design, protection of personal data, approval by worker representation bodies, health and safety, environmental, accessibility requirements) [d] **HCP.4.1.BP4: Develop and review implementation plan with users and stakeholders and modify plan based on their feedback** (including necessary approvals from worker representation bodies). [d, e] **HCP.4.1.BP5: Identify needs for customization or localization, training and documentation.** [a, c] **HCP.4.1.BP6: Define communication to stakeholders and actual or potential users.** [a, f] **HCP.4.1.BP7: Develop and deliver help, instructions and training material.** [g] **HCP.4.1.BP8: Develop and implement a user support system.** [h] **HCP.4.1.BP9: Manage the changes required to introduce the system.** [i] **HCP.4.1.BP10: Identify and monitor human-system issues** when the system is first used. [k] **HCP.4.1.BP11: Identify differences between expected and actual context of use.** [j, l] **HCP.4.1.BP12: Perform user-centred evaluation** after introduction. [l] **HCP.4.1.BP13: Implement improvements** to the interactive system. [j, l]

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

[b] It is possible that this work product will be changed by this process.

Table 29 *(continued)*

Process ID	HCP.4.1
Input work products	CIF.3 Context of use description 02.07 Stakeholder profile 03.10 Project acquisition plan 03.19 Integration strategy[b] 03.21 Transition strategy[b] 03.22 Validation strategy 08.03 Supply agreement 08.09 Quality measures 08.13 Stakeholder requirements constraints on solution
Output work products	CIF.4 User needs [a] 01.06 Qualified operators [g] 01.11 Operational system [d, f] 03.07 Training strategy [g] 03.12 Service management plan [b, e, f] 03.19 Integration strategy [c, e, f][b] 03.21 Transition strategy [k, l][b] 04.04 Implementation procedure [a, c, d, e, g] 04.07 Transition procedure (e, g] CIF.9 Field data report [f, k] 06.02 Delivery acceptance report [j] 06.27 Transition report [k, l] 08.20 Implementation constraints on solution [a, b, c, d] 08.26 Transition constraints on solution [a, b, d] 08.27 Transition enabling system requirements [b, d, e, g, h] Includes user documentation (training materials, guides, online support, user awareness programmes).

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

[b] It is possible that this work product will be changed by this process.

6.5.3 HCP.4.2 – Human-centred quality in operation

Table 30 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.4.2.

Table 30 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.4.2

Process ID	HCP.4.2
Process name	**Human-centred quality in operation**
Process purpose	To address human-system issues in operation and support that impact on human-centred quality and, if necessary, initiate maintenance or redesign.
Process benefit	The factors necessary to maintain human-centred quality with an operational system are known, reported and addressed.

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

Table 30 *(continued)*

Process ID	**HCP.4.2**
Process outcomes	a) The context of use is monitored for changes. b) User reactions and in-service data are analysed. c) Emergent safety, health, environmental and quality issues are addressed. d) The design of maintenance procedures takes account of user feedback and the impact on human-centred quality. e) Maintenance addresses human-system issues. f) Existing functions that are important to users are retained. g) Maintenance does not adversely affect human-centred quality.
Base practices	**HCP.4.2.BP1: Systematically monitor the context of use of the operational system for changes.** [a][a] **HCP.4.2.BP2: Investigate system use** to collect and analyse user and stakeholder feedback for human-system and human-centred quality issues. [b] **HCP.4.2.BP3: Identify use-related human-system issues** of the system, including the extent to which user and maintainer support needs are being met. [b] **HCP.4.2.BP4: Systematically monitor adverse events** to identify emergent health, safety and environmental issues. [b, c] **HCP.4.2.BP5: Assess compliance with applicable health, safety and environmental operational regulations.** [c] **HCP.4.2.BP6: Resolve and document identified health, safety and environmental issues, and verify that solutions do not create additional issues.** [c] **HCP.4.2.BP7: Identify user requirements** for corrective and preventive maintenance strategies, enabling systems or services, as well as resources, needed for maintenance. [d] **HCP.4.2.BP8: Identify and address human-systems issues** in maintenance and re-design and ensure that resolutions do not negatively impact human-centred quality. [e] **HCP.4.2.BP9: Assess the potential impact of new technologies** on usability, maintainability or increased human-centred quality. [a][a] **HCP.4.2.BP10: Assess the impact of changes** on users, including usability, accessibility, user experience and potential harm or benefits that can arise from use. [a] **HCP.4.2.BP11: Assess the impact of changes** on training, help, user support and synchronisation across user platforms. [a] **HCP.4.2.BP12: Prioritize human-system issues.** [g] **HCP.4.2.BP13: Develop a human-centred upgrade list.** [g]
Input work products	CIF.3 Context of use description 01.06 Qualified operators 01.11 Operational system 03.07 Training strategy 03.12 Service management plan 03.23 Operation strategy 05.20 Operation record 08.09 Quality measures

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

Table 30 *(continued)*

Process ID	HCP.4.2
Output work products	CIF.9 Field data report [a, b, c]
	06.03 Supply performance report [b, f]
	06.10 Customer satisfaction report [b, g]
	06.16 Corrective action report [b, c, f, g]
	06.29 Operation report [a, b, c]
	07.10 Operation request [a, b, c, d]
	08.17 Human-equipment interface requirements [c, d, f, g]

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

6.5.4 HCP.4.3 – Human-centred quality during upgrades

Table 31 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.4.3.

Table 31 — Purpose, benefits, outcomes, base practices, input work products and output work products of HCP.4.3

Process ID	HCP.4.3
Process name	**Human-centred quality during upgrades**
Process purpose	Modification of the existing system takes account of the evolution of the context of use and changing user requirements
Process benefit	The factors necessary to maintain or improve human-centred quality with new or revised versions of a system are known, reported and addressed.
Process outcomes	a) User reactions and in-service data are used to define new versions of the system. b) User requirements for the revised system take actual use into account. c) Existing functions that are important to users are retained. d) Identified human-centred quality issues are accepted by supply organizations as objectives for improvement of future systems. e) Upgrades and new versions do not adversely affect human-centred quality. f) Decisions concerning upgrades and new versions take into account user feedback and the impact on human-centred quality.

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

Table 31 *(continued)*

Process ID	HCP.4.3
Base practices	**HCP.4.3.BP1: Assess the potential impact of new technologies** on usability, maintainability or increased human-centred quality. [a][a] **HCP.4.3.BP2: Identify use-related human-system issues of the existing system.** [a] **HCP.4.3.BP3: Investigate actual system usage.** [b] **HCP.4.3.BP4: Analyse user and stakeholder feedback** for human-system and human-centred quality issues [b] **HCP.4.3.BP5: Analyse health, safety, quality and environment issues.** [b] **HCP.4.3.BP6: Identify in what ways the requirements for the future system need to take account of how the existing system is used.** [b] **HCP.4.3.BP7: Develop a human-centred upgrade list.** [c] **HCP.4.3.BP8: Prioritize human-system issues.** [c] **HCP.4.3.BP9: Identify the existing user requirements that are to be retained for the future system.** [c] **HCP.4.3.BP10: Provide feedback to supply organizations** about human-centred quality issues identified in operations so that future systems can be improved. [d] **HCP.4.3.BP11**: **Assess the impact of changes** on human-centred quality. [f] **HCP.4.3.BP12: Assess the potential impact of upgrades** on training, help, user support and synchronisation across user platforms [f] **HCP.4.3.BP13: Modify the system** to address human-system issues identified by evaluation in use. [f]
Input work products	CIF.3 Context of use description 01.06 Qualified operators 03.07 Training strategy 03.22 Validation strategy 03.24 Maintenance strategy 04.07 Transition procedure 04.08 Validation procedure 05.18 Transition record 05.19 Validation record 05.21 Maintenance record 06.10 Customer satisfaction report 07.06 Supplier directive 07.10 Operation request 08.09 Quality measures 08.13 Stakeholder requirements constraints on solution 08.17 Human-equipment interface requirements

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

Table 31 *(continued)*

Process ID	HCP.4.3
Output work products	CIF.9 Field data report [a, b, e] 01.01 Validated system [f] 01.11 Operational system [f] 04.10 Maintenance procedure [e] 06.02 Delivery acceptance report [b, e, f] 06.16 Corrective action report [a, e] 06.18 Risk management report [e, f] 06.30 Maintenance report [c, d, e] 08.30 Maintenance constraints on solution [c, e, f] 08.31 Maintenance enabling system requirements [c, e]

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

6.5.5 HCP.4.4 – Human-centred quality at the end of life of a system

Table 32 describes the purpose, benefits, outcomes, base practices, input work products and output work products associated with HCP.4.4.

Table 32 — Purpose, benefits, outcomes, base practices, input work products and output work products to be conducted within HCP.4.4

Process ID	HCP.4.4
Process name	**Human-centred quality at the end of life of a system**
Process purpose	To take into account the needs of users and stakeholders during the retirement or replacement of a system.
Process benefit	The factors related to human-centred quality at the end of life of a system are known, reported and addressed.
Process outcomes	a) User requirements for the new system take actual use into account. b) Existing functions that are important to the user are retained. c) User reactions and in-service data are used to define future versions of the system. d) The reallocation, departure from employment and/or transfer of users are defined and actioned, and affected users are adequately supported during the process. e) User requirements for the replacement(s) of the system are identified. f) The health, safety, security, privacy, regulatory and environmental issues associated with removal from service and/or system disposal are identified and addressed. g) Human-centred quality is maintained during transition to replacement systems. h) User feedback and the impact on human-centred quality are considered as part of the decision to remove or replace a system.

[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.

Table 32 *(continued)*

Process ID	HCP.4.4
Base practices	**HCP.4.4.BP1: Investigate actual system usage.** [a][a] **HCP.4.4.BP2: Identify in what ways the requirements for the future system need to take account of how the existing system is used.** [b, h] **HCP.4.4.BP3: If the system is being replaced, consider evolution of usage scenarios (users, user goals, and context of use) over the system shutdown process.** [a, b, c, e, g] **HCP.4.4.BP4: Identify whether there are any consequences for users related to loss of the system.** [b, e, f, g, h] **HCP.4.4.BP5: Develop a plan for system retirement, disposal and/or replacement.** [g] **HCP.4.4.BP6: Conduct debriefing and retrospective analysis for a replacement system.** [c, e] **HCP.4.4.BP7: Identify use-related human-system issues of the existing system.** [c, g, h] **HCP.4.4.BP8: Collect and analyse in-service reports** to generate updates or lessons learnt for the next version of the system. [c, g, h] **HCP.4.4.BP9: Define how users will be reallocated, dismissed, transferred to other duties.** [d] **HCP.4.4.BP10: Communicate system end of life and potential alternatives to users.** [d] **HCP.4.4.BP11: Plan break-up of social structures.** [d] **HCP.4.4.BP12: Identify risks** including health and safety issues associated with removal from service and destruction of the system. [f] **HCP.4.4.BP13: Apply relevant health, safety, regulatory and environmental regulations** applicable to system destruction and/or disposal. [f]
Input work products	03.26 Disposal strategy
Output work products	CIF.3 Context of use description [a, b] CIF.9 Field data report [c, e] 04.15 Disposal procedure [d, f] 05.04 Risk register [f] 06.31 Disposal report [d, f] 08.32 Disposal constraints on solution [b, d, f, g, h] 08.33 Disposal enabling systems requirements [d, e, f, g, h]
[a] The reference in the brackets indicates the relationship of the base practice to the process outcomes.	

7 Process capability levels and process attributes (Levels 0 to 5)

7.1 General

PCIs (see 5.4) are the means of achieving the capabilities addressed by the considered PAs (see Annex A, Figure A.1). Evidence of PCIs supports the assessment of the degree of achievement of the PA. The capability dimension of the PAM consists of six capability levels matching the capability levels defined in ISO/IEC 33020. The PCIs for the nine PAs (see Table 3), which are included in the capability dimension for process capability levels 0 to 5 (see Table 2), are described in 7.2 to 7.7. Each of the PAs in this PAM is identical to the PA defined in the process measurement framework in ISO/IEC 33020:2019, Clause 5. The generic practices (GPs) address the characteristics under each PA. Process capability level 0 does not include any type of process indicators, as it reflects a non-implemented process or a process which fails to partially achieve any of its outcomes.

7.2 Process capability level 0: Incomplete process

The process is not implemented or fails to achieve its process purpose. At this level, there is little or no evidence of any systematic achievement of the process purpose.

7.3 Process capability level 1: Performed process

7.3.1 General

The implemented process achieves its process purpose. PA 1.1 in 7.3.2 demonstrates the achievement of this level.

7.3.2 PA 1.1 – Process performance process attribute

7.3.2.1 General

The process performance PA is a measure of the extent to which the process purpose is achieved. As a result of full achievement of the process attribute outcome of this PA ([ACHIEVEMENT]), the process achieves its defined process outcomes.

NOTE [ACHIEVEMENT] in square brackets denotes all necessary process attribute outcomes. For PA 1.1, there is only one process attribute outcome that must be achieved, indicated by "a)".

7.3.2.2 Generic practices for PA 1.1

GP 1.1.1 – **Achieve the process outcomes** [ACHIEVEMENT a]

Achieve the intent of the BPs. Relevant information items to evidence achievement of the process outcomes are identified.

7.4 Process capability level 2: Managed process

7.4.1 General

The previously described performed process is now implemented in a managed fashion (planned, monitored and adjusted) and its documented information is appropriately established, controlled and maintained.

PAs 2.1 to 2.2, together with the previously defined PA 1.1, demonstrate the achievement of this level.

7.4.2 PA 2.1 – Performance management process attribute

7.4.2.1 General

The performance management process PA is a measure of the extent to which the performance of the process is managed with necessary resources and competencies.

As a result of full achievement of this PA ([ACHIEVEMENTS]):

a) results to be achieved are determined and communicated;

b) risks that can affect performance of the process are determined and addressed;

c) performance goals of the process are planned, monitored, measured, evaluated and adjusted (as needed);

d) responsibilities and authorities for performing the process are determined, assigned and communicated;

e) resources necessary for performing the process are determined, provided and maintained (as needed);

f) person(s) performing the process are competent on the basis of appropriate education, training or experience;

g) interfaces between the involved parties are managed to ensure both effective communication and the level of control expected.

NOTE 1 Results to be achieved can include quality criteria for documented information, process cycle time or frequency, resource usage and boundaries of the process.

NOTE 2 Techniques for progress monitoring and evaluation can include: milestone achievement, percentage completed towards next milestones, elapsed time compared with estimated time of activities, actual resource usage compared with planned requirements, experienced persons' estimate of percentage of activities completed or work packages, burn down charts representing measurable progress such as outstanding work (or backlog) over time (or story points).

NOTE 3 Resources include people, infrastructure and environment for the operation of processes. Infrastructure can include buildings and associated utilities, equipment (including hardware and software), transportation resources and information and communication technology. A suitable environment can be a combination of human and physical factors, including social and psychological environmental factors. Resources include internal and external resources and can include customers and users. The term "resources" is defined in ISO/IEC/IEEE 24765.

NOTE 4 Applicable actions to acquire necessary competencies can include, for example, the provision of training to, the mentoring of or the reassignment of persons, or the hiring or contracting of competent persons.

NOTE 5 Addressing risk establishes a basis for achieving improved results and preventing negative effects. Actions taken to address risks can be proportionate to the potential impact. Options to address risk can include avoiding the risk, taking risk in order to pursue an opportunity, eliminating risk source, changing the likelihood or consequences, sharing the risk or retaining risk by informed decision.

7.4.2.2 Generic practices for PA 2.1

GP 2.1.1 – **Determine results to be achieved** for the performance of the process. [ACHIEVEMENT a].

Results to be achieved are determined.

Process performance goals are defined.

Assumptions and constraints are considered when identifying the performance goals.

Results to be achieved are communicated to involved parties.

NOTE 1 Process performance goals for resources, effort, schedule and output are normally stated.

NOTE 2 The letter behind the generic practices in square brackets following ACHIEVEMENT (e.g. [ACHIEVEMENT a]) represents the relationship between the GPs and the required PA outcomes to achieve in the relevant PA outcome list indicated by letters.

GP2.1.2 – **Determine and address risks** relevant to the performance of the process. [ACHIEVEMENT b].

Risks that can affect performance of the process are identified and evaluated for effect and severity.

Actions to mitigate the risks are planned and performed.

Monitor the risks and record the mitigation activities throughout the performance of the process.

GP 2.1.3 – **Plan the performance** of the process to achieve the determined results. [ACHIEVEMENT c].

Plan(s) for the performance of the process are developed.

Process activities and tasks are defined.

Schedule and milestones are defined and aligned with the approach to performing the process.

Documented information reviews are planned.

GP 2.1.4 – **Control the performance** of the process. [ACHIEVEMENT c].

Process performance measures are established.

Process performance is monitored and the results are controlled.

Appropriate actions are taken when planned results are not achieved.

The plan(s) are adjusted and rescheduling is performed, as necessary.

GP 2.1.5 – **Assign competent people** with the relevant responsibilities and authorities for performing the process. [ACHIEVEMENT d,f].

Responsibilities and authorities to perform the process are determined, assigned and communicated.

Required competencies are identified, based on the responsibilities.

Competencies for management and execution of the process are ensured through training or work-based learning.

Person(s) performing the process are considered competent on the basis of appropriate education, training or experience.

Necessary competencies are acquired externally when needed.

GP 2.1.6 – **Allocate and maintain resources** to perform the process according to plan. [ACHIEVEMENT e].

The human and infrastructure resources needed for performing the process are determined, provided and maintained.

The information necessary to perform the process is identified and made available.

The use of the resources is measured and monitored to identify possible deviations.

GP 2.1.7 – **Manage the interfaces** among the involved parties. [ACHIEVEMENT g].

The individuals and groups involved in the process performance are identified.

Responsibilities of the involved parties are assigned.

Communication is assured among the involved parties.

Communication among the involved parties is effective.

7.4.3 PA 2.2 – Documented information management process attribute

7.4.3.1 General

The documented information management PA is a measure of the extent to which the documented information produced internally or acquired from an external source when performing the process is appropriately managed.

As a result of full achievement of this PA ([ACHIEVEMENTS]):

a) requirements for the documented information of the process are determined;

b) requirements for the control of the documented information are determined;

c) documented information is appropriately identified and controlled according to requirements;

d) documented information is reviewed and approved for suitability and adequacy, in accordance with planned arrangements, and adjusted as necessary to meet requirements;

e) documented information is determined, maintained and retained to the extent necessary to have confidence that the process has been performed as planned and to demonstrate the conformity of products and/or services to their requirements.

NOTE 1 Requirements for the control of documented information can include requirements for the identification and description, format and media, control of changes (e.g. version control), distribution, retrieval and use, storage, preservation, including preservation of legibility, retention and disposition, and for making it available and suitable for use when and where it is needed.

NOTE 2 The documented information referred to in this clause is that which results from the achievement of the process purpose through the process outcomes.

7.4.3.2 Generic practices for PA 2.2

GP 2.2.1 **Define the requirements** for the documented information. [ACHIEVEMENT a].

The requirements for the documented information to be produced are defined. Requirements may include defining contents and structure.

Quality criteria for the documented information are identified.

Appropriate review and approval criteria for the documented information are defined.

GP 2.2.2 **Define the requirements for documentation and control** of the documented information. [ACHIEVEMENT b].

Requirements for the documentation and control of the documented information are defined. Such requirements may include requirements for a) distribution, b) identification of documented information and their components and c) traceability.

Dependencies among pieces of documented information are identified and understood.

Requirements for the approval of documented information to be controlled are defined.

GP 2.2.3 **Identify and control** the documented information in accordance with requirements. [ACHIEVEMENT c].

The documented pieces of information to be controlled are identified.

Change control is established for documented information.

The documented information is identified and controlled in accordance with requirements.

Versions of documented information are assigned to product configurations as applicable.

The documented information is made available through appropriate access mechanisms.

The revision status of the documented information can readily be ascertained.

GP 2.2.4 **Review and adjust** documented information to meet the defined requirements. [ACHIEVEMENT d].

Documented information is reviewed against the defined requirements, in accordance with planned arrangements.

Issues arising from documented information reviews are resolved.

GP 2.2.5 **Maintain and retain information products** to demonstrate that planned results are achieved. [ACHIEVEMENT e].

Documented information needed to confirm the performance of the process is determined.

Documented information is used to demonstrate that the products and/or services satisfy their requirements.

7.5 Process capability level 3: Established process

7.5.1 General

The previously described managed process is now implemented using a defined process which is assured and continually improved.

PAs 3.1 to 3.3, together with the previously defined PAs, demonstrate the achievement of this level.

7.5.2 PA 3.1 – Process definition process attribute

7.5.2.1 General

The process definition PA is a measure of the extent to which a standard process is established and maintained.

As a result of full achievement of this PA ([ACHIEVEMENTS]):

a) a standard process, including appropriate tailoring guidelines, is established and maintained that describes the fundamental elements that must be incorporated into a defined process;

b) the required inputs and the expected outputs for the standard process are determined;

c) sequence and interaction of the standard process with other processes is determined;

d) roles, competencies, responsibilities and authorities for performing the standard process are determined;

e) resources for performing the standard process are determined;

f) knowledge necessary for the operation of the standard process is determined and maintained.

NOTE Knowledge can be based on internal sources (e.g. intellectual property, knowledge gained from experience, lessons learned and the results of improvements in the process) and external sources (e.g. standards, academia, conferences, customers and external providers).

When addressing changing needs and trends, the need to acquire or access any necessary additional knowledge and required updates should be considered.

7.5.2.2 Generic practices for PA 3.1

GP 3.1.1 **Establish and maintain a standard process** that will support the deployment of the defined process. [ACHIEVEMENT a].

A standard process is developed and maintained which includes the fundamental process elements.

The standard process identifies the deployment needs and deployment context.

Guidance and/or procedures are provided to support implementation of the process as needed.

Appropriate tailoring guideline(s) are made available as needed.

The standard process is maintained to meet the improvement needs and opportunities.

GP 3.1.2 **Determine the inputs and outputs** of the standard process. [ACHIEVEMENT b].

Required inputs are identified, including the information needed.

Expected outputs are identified.

Start and stop criteria for the standard process are defined as needed.

GP 3.1.3 **Determine the sequence and interaction of the process** as an integrated system of processes. [ACHIEVEMENT c].

The processes' sequence and interaction with other processes are determined.

Deployment of the standard process as a defined process maintains the integrity of the processes.

GP 3.1.4 **Determine the roles, competencies, responsibilities and authorities** for performing the standard process. [ACHIEVEMENT d].

Roles and related competencies for performing the process are determined.

Authorities necessary for executing responsibilities are determined.

GP 3.1.5 **Determine the resources** for performing the standard process. [ACHIEVEMENT e].

Appropriate resources are identified and determined.

Requirements for the quality of the resources are defined.

Process infrastructure components are identified (e.g. facilities, tools, networks, methods).

Work environment requirements are defined.

GP 3.1.6 **Determine and maintain necessary knowledge** for the operation of the standard process. [ACHIEVEMENT f].

Information and understanding needed to perform the process are determined and maintained.

NOTE Knowledge includes facts, information and skills acquired by a person through experience or education; it is considered to be the theoretical or practical understanding of a subject.

7.5.3 PA 3.2 – Process deployment process attribute

7.5.3.1 General

The process deployment PA is a measure of the extent to which the standard process is deployed as a defined process.

As a result of full achievement of this PA ([ACHIEVEMENTS]):

a) a defined process is deployed, based upon an appropriately tailored standard process;

b) required roles, responsibilities and powers necessary for performing the defined process are assigned and communicated;

c) required person(s) necessary for performing the defined process are competent on the basis of defined education, training and experience;

d) required resources necessary for performing the defined process are made available, monitored and measured;

e) documented information is made available to ensure that the defined process achieves its intended results.

7.5.3.2 Generic practices for PA 3.2

GP 3.2.1 **Deploy a defined process** that satisfies the context-specific requirements of the use of the standard process. [ACHIEVEMENT a].

The defined process is appropriately selected and/or tailored from the standard process.

Criteria to verify conformity of the defined process with the standard process are determined.

The defined process is used to achieve the process outcomes.

GP 3.2.2 **Deploy competent people** with defined responsibilities and authorities to support the performance of the defined process. [ACHIEVEMENT b,c].

Competency criteria for the required roles are defined.

The roles for performing the defined process are assigned and communicated.

The responsibilities and authorities for performing the defined process are assigned and communicated.

Competency of the required person(s) is monitored and maintained with appropriate education, training or experience.

GP 3.2.3 **Provide resources and information** to support the performance of the defined process. [ACHIEVEMENT d].

Required human resources are made available, allocated and used.

Required information to perform the process is made available, allocated and used.

Resources are measured and monitored to ensure their effective use.

GP 3.2.4 **Maintain documented information** as evidence of the process achieving its expected results. [ACHIEVEMENT e].

Documented information is maintained.

Documented information is available for review.

Documented information can be verified by person(s) independent of those performing the process.

7.5.4 PA 3.3 – Process assurance process attribute

7.5.4.1 General

The process assurance PA is a measure of the extent to which the defined process is assured and continually improved.

As a result of full achievement of this PA ([ACHIEVEMENTS]):

a) appropriate data and information are collected and analysed from monitoring and measurement of the process, in order to evaluate the effectiveness and risks of the process and to identify needs and opportunities for improvement;

b) criteria and methods needed to ensure effective operation and control, and continuing suitability, adequacy, effectiveness and risks associated of the process are determined and evaluated;

c) conformity of the defined process (and of associated activities, outputs and documented information) is objectively assured;

d) action is taken on any nonconformity, based on its nature and effect, and tracked to closure;

e) the standard process is continually improved, based on identified needs and opportunities.

7.5.4.2 Generic practices for PA 3.3

GP 3.3.1 **Collect and analyse data about performance of the process** to identify need for improvement. [ACHIEVEMENT a].

Data required to understand the behaviour, suitability and effectiveness of the process are identified, collected and analysed.

Results of the analysis are used to identify where continual improvement of the standard and/or defined process can be made.

Data about process performance may be qualitative or quantitative.

GP 3.3.2 **Determine suitable methods and measures** to monitor and evaluate the process. [ACHIEVEMENT b].

Methods and measures for monitoring the suitability, effectiveness and adequacy of the process are determined.

Appropriate criteria and data needed to monitor the process are defined.

The need to conduct internal audits, process compliance audits or reviews and management reviews is established.

Suitability, adequacy and effectiveness of the process are measured and analysed continually using appropriate methods.

Identified risks are evaluated and managed.

GP 3.3.3 **Ensure conformity** of the defined process. [ACHIEVEMENT c].

Associated activities, outputs and documented information are evaluated.

Conformity of the defined process with the standard process requirements is verified.

Any nonconformities are identified and documented.

Assurance activities are performed independently of the process instance, in order to ensure objectivity.

GP 3.3.4 **Act on nonconformities** to adjust the performance of the process. [ACHIEVEMENT d].

The nature and effect of nonconformities are analysed to plan appropriate actions.

Any changes needed are implemented to ensure that the process achieves its intended results.

Actions are managed and tracked to closure.

GP 3.3.5 **Improve the process** based on its monitoring of the process. [ACHIEVEMENT e].

Suitability, adequacy and effectiveness of the process are measured and analysed continually, using appropriate methods.

Internal audits, process capability audits or reviews and management reviews are performed when needed.

Process changes are implemented to maintain the standard process.

7.6 Process capability level 4: Predictable process

7.6.1 General

The previously described established process is now performed predictively. Quantitative management needs are identified; measurement data are collected and analysed to identify assignable causes of variation. Corrective action is taken to address assignable causes of variation.

PAs 4.1 to 4.2, together with the previously defined PAs, demonstrate the achievement of this level.

7.6.2 PA 4.1 – Quantitative analysis process attribute

7.6.2.1 General

The quantitative analysis PA is a measure of the extent to which information needs are defined, relationships between process elements are identified and data are collected.

As a result of full achievement of this PA ([ACHIEVEMENTS]):

a) process information needs in support of relevant, defined, quantitative business goals are established;

b) process measurement objectives are derived from process information needs;

c) measurable relationships among process elements that contribute to the process performance are identified;

d) quantitative objectives for process performance are established to support relevant business goals;

e) appropriate measures and frequency of measurement are identified and defined in line with process measurement objectives and quantitative objectives for process performance;

f) techniques for analysing the collected data are selected;

g) results of measurement are collected, validated and reported in order to monitor the extent to which the quantitative objectives for process performance are met.

NOTE 1 Information needs typically reflect management, technical, project, process or product needs.

NOTE 2 Measures can be either process measures or product measures or both.

NOTE 3 Techniques for quantitative data analysis can include statistical and mathematical methods – data tabulation, descriptive data, data aggregation or disaggregation and other advanced analytical methods, such as correlation, analysis of variance and regression.

7.6.2.2 Generic practices for PA 4.1

GP 4.1.1 **Establish process information needs**, in support of quantitative business goals. [ACHIEVEMENT a].

Quantitative business goals relevant to the process are identified.

Stakeholders of the identified business goals and the quantitatively measured process and their information needs are identified, defined and agreed.

GP 4.1.2 **Derive process measurement objectives** from process information needs. [ACHIEVEMENT b].

Process measurement objectives to satisfy defined process information needs are derived.

GP 4.1.3 **Identify measurable relationships** among process elements. [ACHIEVEMENT c].

Relationships among process elements are determined, which in turn contribute to the derived measurement objectives.

GP 4.1.4 **Establish quantitative objectives** for the performance of the defined process, according to the alignment of the process with the business goals. [ACHIEVEMENT d].

Process performance objectives are defined to explicitly reflect the quantitative business goals.

Process performance objectives are validated in consultation with process stakeholders, so that they prove to be realistic and useful.

GP 4.1.5 **Identify product and process measures** that support the achievement of the quantitative objectives for process performance. [ACHIEVEMENT e].

Detailed measures are defined to support monitoring, analysis and verification needs of the quantitative objectives.

Frequency of data collection is defined.

Algorithms and methods to create derived measurement results from base measures are defined, as appropriate.

The verification mechanism for base and derived measures is defined.

NOTE 1 Typically, the standard process definition is extended to include the collection of data for process measurement.

GP 4.1.6 **Select analysis techniques**, appropriate to collected data. [ACHIEVEMENT f].

Process control analysis methods and techniques are defined.

Selected techniques are validated against process control objectives.

GP 4.1.7 **Collect product and process measurement results** through performing the defined process. [ACHIEVEMENT g].

Data collection mechanism is created for all identified measures.

Required data are collected in an effective and reliable manner.

Measurement results are created from the collected data and analysed within the defined frequency.

Measurement results are reported to those responsible for monitoring the extent to which quantitative objectives are met.

NOTE 2 A product measure can contribute to a process measure.

7.6.3 PA 4.2 – Quantitative control process attribute

7.6.3.1 General

The quantitative control PA is a measure of the extent to which objective data are used to manage and control process performance that is predictable.

As a result of full achievement of this PA ([ACHIEVEMENTS]):

a) assignable causes of process variation are determined through analysis of the collected data;

b) distributions that characterize the performance of the process are established;

c) corrective actions are taken to address assignable causes of variation;

d) separate distributions are established (as necessary) for analysing the process under the influence of assignable causes of variation;

e) process performance data are used to develop predictors of process outcome.

7.6.3.2 Generic practices for PA 4.2

GP 4.2.1 **Determine assignable causes of process variation** by analysing the collected data. [ACHIEVEMENT a].

Variation in process performance is attributed to a specific, unpredictable cause.

Assignable cause indicates a possible problem in the defined process.

GP 4.2.2 **Establish distributions** that characterize the process performance. [ACHIEVEMENT b].

Variation in measurement results is used to analyse process performance.

Deviations are analysed to identify potential cause(s) of variation.

Trends of process performance are identified.

GP 4.2.3 **Identify and implement corrective actions** to address assignable causes. [ACHIEVEMENT c].

Results are provided to those responsible for taking action.

Corrective actions are determined to address each assignable cause.

Corrective actions are implemented to address assignable causes of variation.

Corrective action results are monitored.

Corrective actions are evaluated to determine their effectiveness.

GP 4.2.4 **Establish separate distributions** for analysing the process [ACHIEVEMENT d].

Consequences of process variation are analysed.

Distributions are used to quantitatively understand process performance under the influence of assignable causes of variation.

GP 4.2.5 **Develop predictors** for process outcomes. [ACHIEVEMENT e].

Process performance data are used.

Predictors are independent variables used to forecast process outcomes.

7.7 Process capability level 5: Innovating process

7.7.1 General

The previously described predictable process is now continually improved to respond to changes through identified innovative approaches for process innovation.

PA 5.1, together with the previously defined PAs, demonstrates the achievement of this level.

7.7.2 PA 5.1 – Process innovation process attribute

7.7.2.1 General

The process innovation PA is a measure of the extent to which changes to the definition, management and performance of the process are identified and effectively implemented, based on identified innovative approaches for process innovation, by using internal resources and/or using external ideas, according to defined process innovation objectives.

As a result of full achievement of this PA ([ACHIEVEMENTS]):

a) process innovation objectives are defined for the processes that support relevant business goals;

b) appropriate data are analysed to identify opportunities for best practice and innovation;

c) innovation opportunities derived from new technologies and process concepts are identified;

d) an implementation strategy is established to achieve the process innovation objectives;

e) impact of all proposed changes is assessed against the objectives of the defined process and standard process;

f) implementation of all changes agreed upon is managed to ensure that any disruption to the process performance is understood and acted upon;

g) effectiveness of process change based on actual performance is evaluated against the defined product requirements and process and innovation objectives.

7.7.2.2 Generic practices for PA 5.1

GP 5.1.1 **Define the process innovation objectives** for the process that support the relevant business goals. [ACHIEVEMENT a].

New business visions and goals are analysed to give guidance for new process objectives and potential areas of process innovation.

Quantitative and qualitative process innovation objectives are defined and documented.

GP 5.1.2 **Analyse data** of the process to identify opportunities for best practices and innovation. [ACHIEVEMENT b].

Feedback on opportunities for innovation is actively sought, including analysis of the results from the process measurements.

Innovation opportunities are identified.

Best practices are identified and evaluated.

GP 5.1.3 **Identify innovation opportunities** of the process, based on new technologies and process concepts. [ACHIEVEMENT c].

Possibilities of new process concepts for the innovation of process performance are identified and evaluated.

Impact of new technologies on process performance is identified and evaluated.

Emergent risks are considered in evaluating improvement opportunities.

GP 5.1.4 **Define and maintain an implementation strategy,** based on the vision and objectives for long-term innovation. [ACHIEVEMENT d].

Commitment to innovation is demonstrated by organizational management, including the process owner(s) and other relevant stakeholders.

Measures that validate the results of process changes are defined to determine the expected effectiveness of the process changes and the expected impact on defined business objectives.

The proposed process changes are planned and prioritized, based on their impact on defined innovation objectives.

GP 5.1.5. **Assess the impact of each proposed change** against the objectives of the defined and standard process. [ACHIEVEMENT e].

Objective priorities for process innovation are established.

Specified changes are assessed against product quality and process performance requirements and goals.

The impact of the changes made to other defined and standard processes is considered.

GP 5.1.6. **Manage the implementation of changes agreed upon**. [ACHIEVEMENT f].

A mechanism is established for incorporating accepted changes into the defined and standard process(es) effectively and completely.

The factors that impact the effectiveness and full deployment of the process change are identified and managed, such as:

— economic factors (productivity, profit, growth, efficiency, quality, competition, resources and capacity);

— human factors (job satisfaction, motivation, morale, conflict or cohesion, goal consensus, participation, training and span of control);

— management-related factors (skills, commitment, leadership, knowledge, ability, organizational culture and risks);

— technological factors (sophistication of system, technical expertise, development methodology and need for new technologies).

Training is provided to users of the process.

Process changes are effectively communicated to all affected parties.

Records of the change implementation are maintained.

GP 5.1.7. **Evaluate the effectiveness of process change**. [ACHIEVEMENT g].

The performance and capability of the changed process are measured and compared with historical data.

A mechanism is available for documenting and reporting analysis results to the management and owners of standard and defined processes.

Measures are analysed, in order to evaluate the effectiveness of process changes.

Other feedback is recorded, such as opportunities for further innovation of the standard process.

Annex A
(informative)

Explanation of the process reference and PAMs

A.1 General

ISO/IEC/TS 33030 describes in detail how to establish and conduct standardized assessments. An overall introduction to the terms and principles of conducting standardized assessments can be found in ISO/IEC 33001.

A.2 Process capability determination in general

The concept of process capability determination by using a PAM is based on a two-dimensional framework. The first dimension is provided by processes defined in a PRM (process dimension). The second dimension defines and provides the necessary details, which enable the assessor to determine the capability levels (capability dimension). The PAs provide the measurable characteristics of process capability. The Y-axis signifies the "process capability levels" constituted by "PAs" represented by "process indicators". The X-axis indicates the rating of the "process outcomes" based on the "process indicators".

The PAM selects processes from a selected PRM and supplements them with indicators. These indicators support the collection of objective evidence, which enables an assessor to assign ratings for processes according to the capability dimension. The relationship is shown in Figure A.1.

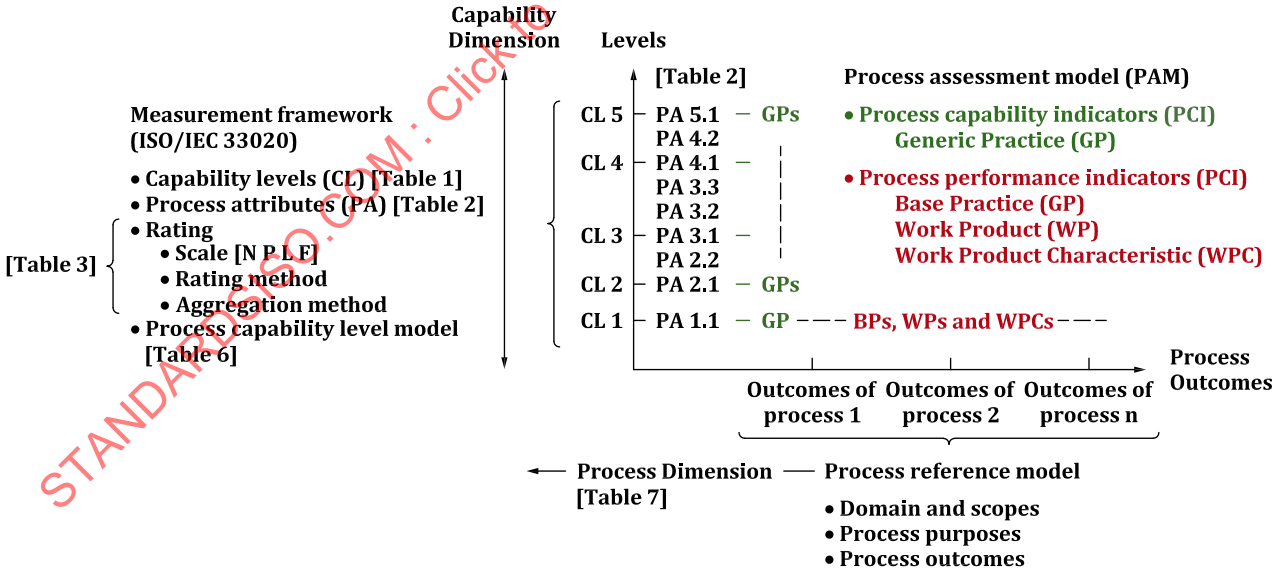

Figure A.1 — Relationship between process indicators and process capability

A.3 Process reference model

A.3.1 General

Processes are grouped by process category. There are four process categories:

— HCP.1 (Ensure);

— HCP.2 (Enable);

— HCP.3 (Execute);

— HCP.4 (Introduction).

Each process is described in terms of a purpose statement. The purpose statement contains the unique functional objectives of the process when it is performed in a particular environment. For each purpose statement, a list of specific outcomes is associated. Outcomes are expected positive results of process performance. All outcomes count in achieving the process.

A.3.2 Organizational life cycle processes category

The organizational life cycle processes category consists of processes that develop process, product and resource assets which, when used by projects in the organization, help the organization to achieve its business goals. The organizational life cycle processes category consists of the following groups:

— the HCP.1 ensure process group;

— the HCP.2 enable process group.

A.3.3 Primary life cycle processes category

The primary life cycle processes category consists of processes that may be used by the customer when acquiring products from a supplier, and by the supplier when responding and delivering products to the customer. This includes the engineering processes needed for specification, design, development, integration and testing. The primary life cycle processes category consists of the following groups:

— the HCP.3 execute process group;

— the HCP.4 introduce and operate process group.

The HCP.3 execute process group consists of processes addressing the elicitation and management of customer and internal requirements, the definition of the system architecture and the integration and testing on the system level.

A.3.4 Using the HCD PAM described in this document with other PRMs and PAMs

The usage of the PAM in this document depends on the scope and objective of the assessment and several other reasons. For example, if a user wants to do a process improvement assessment regarding HCD, then this document is sufficient. If a user wants to assess all aspects of product quality, then they need to use ISO/IEC TS 33060 and the HCD PAM in this document. It is the lead assessors' professional responsibility to select and tailor the right PAMs and the appropriate set of processes from all PRMs.

There are also other processes (e.g. system or software engineering, support or management processes) necessary to obtain the whole product (system development). HCD does not make the system completely. For example, if HCD is based on software, ensure that SPICE is fulfilled, at least as the HCD PAM in this document is fulfilled. In order to apply this document to deliver usable software, the assessment employed by the SPICE processes to deliver the system shall be included (e.g. by tailoring ISO/IEC TS 33060 to cover the whole product).

There is a difference between achieving HC quality (ISO/IEC/IEEE 15288) and high-level capability levels, in increasing productivity in organizations (ISO 9001) and general product quality (ISO/IEC/IEEE 15288).

NOTE Assessors can find useful information in ISO/IEC 33020:2019, Annexes A to D.

Annex B
(informative)

Conformity of the process assessment and reference models with ISO/IEC 33004

The HCD PAM in this document and the HCD PRM described in ISO 9241-220 meet the requirements for conformity defined in ISO/IEC 33004. The PAM can be used in the performance of assessments that meet the requirements of ISO/IEC 33002. This clause serves as the statement of conformity of the PAM and PRM to the requirements defined in ISO/IEC 33004:2015, 5.5 and 6.4.

Each requirement is referred to only by its number in Tables B.1 and B.2. The full text of the requirements can be found in ISO/IEC 33004.

Table B.1 — Conformity to the requirements for process reference models

Clause in ISO/ IEC 33004:2015	Claim of conformity
5.3.1	ISO 9241-220 contains a PRM for HCD. Within that document, the domain and the intended context of use (interactive systems) are declared in Clause 1 and described in Clause 8. The processes are described in Clause 9. The relationships among the processes are described in Clause 7.
5.3.2	The PRM for HCD was developed by ISO/TC 159/SC 4. Consensus was achieved through the international standards development process. The comments and resolutions for every stage of the ISO review process are available on the ISO standards development portal.
5.3.3	The processes defined in the PRM have a unique description that follows the requirements of ISO/IEC/IEEE 24774, identification with the suffix HCP and numbering scheme as used in ISO/IEC 33004 process models.
5.4	The process descriptions in the ISO 9241-220 PRM follow the requirements of ISO/IEC/IEEE 24774.
5.5	The development of the PRM in ISO 9241-220 uses the requirements of ISO/IEC 33004 and the recommendations of ISO/IEC/IEEE 24774 as product requirements throughout its development and the ISO review process. Drafts and comment dispositions are retained on the ISO standards development portal.

Table B.2 — Conformity to the requirements for PAMs

Clause in ISO/ IEC 33004:2015	Claim of conformity
6.1	The purpose of this PAM is to support assessment of process capability within the HCD domain, using the process measurement framework defined in ISO/IEC 33020.
6.2	The process scope of this PAM is defined in the PRM, included in Clause 6 of this document. The HCD PRM satisfies the requirements of ISO/IEC 33004:2015, Clause 5, as described in Clause A.2. The process capability scope of this PAM is defined in the process measurement framework specified in ISO/IEC 33020, which defines a process measurement framework for process capability satisfying the requirements of ISO/IEC 33003.
6.3.1	This document contains a PAM for HCD. The process quality characteristic that is assessed using this PAM is “capability”.
6.3.2	The PAM in this document incorporates the process measurement framework specified in ISO/IEC 33020, which satisfies the requirements of ISO/IEC 33003 and is based on the process quality characteristic “capability”.

Table B.2 *(continued)*

Clause in ISO/ IEC 33004:2015	Claim of conformity
6.3.3	The PAM in this document is based on the HCD PRM defined in ISO 9241-220 and on the process measurement framework defined in ISO/IEC 33020.
6.3.4	The PAM in this document relates to all the processes of the PRM defined in ISO 9241-220.
6.3.5 a) to d)	The scope of the PAM in this document is declared in Clause 1. All capability levels defined in the process measurement framework from ISO/IEC 33020 are selected for all processes in the PRM(s) in Clause 5.
6.3.5 e)	In the capability dimension, this PAM addresses all the PAs and capability levels defined in the process measurement framework in ISO/IEC 33020.
6.3.6	The selected process measurement framework does not provide a nominal scale, but an ordinal scale. Therefore, all the defined PAs, including the PPIs, are addressed by the PAM in Clauses 6 and 7.
6.3.7	The selected process measurement framework does not provide a nominal scale, but an ordinal scale. In Clause 6, for all processes, the PPIs are defined and related to the PAs defined in Clause 7, for all capability levels of the process measurement framework defined in Clause 5.
6.3.1	Assessment indicators are defined for each process in the PRM in Clause 6, addressing the purpose and the process outcomes [PPIs (BPs and WPs)]. For all processes and capability levels, the PAs are defined by GPs, indicating the necessary achievements to demonstrate the process quality characteristics, according to the capability of the processes in Clause 7.
6.3.2	The mapping between PAM and PRM, as well as the PAs of the process measurement framework, is defined in Clause 5, performed in Clauses 6 and 7 and exemplified in Annex A by Figure A.1.
6.3.3	Assessment results can be derived from the rating of the BPs and the GP, along with the rating of the PAs summarized by the capability level of each process, according to the rating rules defined in the process measurement framework in Clause 5.
6.4	The development of the PAM in this document used the requirements of ISO/IEC 33004 and the recommendations of ISO/IEC/IEEE 24774 as product requirements throughout its development and the ISO review process. Drafts and comment dispositions are retained on the ISO standards development portal.

Annex C
(informative)

Attributes to look for in work products as part of an assessment

C.1 General

WPCs listed in this annex can be used while reviewing potential outputs of process implementation. The characteristics are provided as guidance for the attributes to look for in a sample WP, in order to provide objective evidence supporting the assessment of a process. A documented process and assessor judgement are needed to ensure that the process context (e.g. application domain, business purpose, development methodology, size of the organization) is considered when using this information. WPs are defined using the schema in Table C.1. WPs and their characteristics should be considered as a starting point for considering whether, given the context, they are contributing to the intended purpose of the process, and not as a checklist of what every organization could have.

NOTE Each WP is prefixed by a reference number that indicates the WP and the standard according to which it is defined. WPs from ISO/TR 25060 are preceded by "CIF".

C.2 Process work product list

C.2.1 Format of the list

Table C.1 — Structure of WPC tables

WP identifier	An identifier number for the WP, which is used to reference the WP.
WP name	Provides an example of a typical name associated with the WPC. This name is provided as an identifier of the type of WP the practice or process could produce. Organizations can call these WPs by different names. The name of the WP in a particular organization is not significant. Similarly, organizations may have several equivalent WPs, which contain the characteristics defined in one WP type. The formats for the WPs can vary. It is up to the assessor and the organizational unit coordinator to map the actual WPs produced in their organization to the examples given here.
WPC	Provides examples of the potential characteristics associated with the WP types. The assessor may look for these in the samples provided by the organizational unit. WPs (with the ID NN-00) possess sets of characteristics that would be expected to be evident in WPs of generic types, as a result of achievement of an attribute. The generic WPs form the basis for the classification of specific WPs defined as PPIs. Specific WP types are typically created by process owners and applied by process deployers in order to satisfy an outcome of a particular process purpose.

C.2.2 Types of work products

Table C.2 provides an overview of the WP categories described by WP ID, generic WP name and generic WPC.

Table C.2 — Types of WPs

WP ID	Generic WP name	Generic WPC
01.00	Object	An entity created to serve a purpose or created in the course of serving that purpose. Its existence is observable and rationalized by its material or behavioural characteristics. It can exist as a complete, partial or exemplifying realization of a product, be a subordinate part of a product, be a by-product or be a part of an enabling system.
02.00	Description	An account or representation of a proposed or actual object or concept. It can be a textual, pictorial, graphical or mathematical representation. It can be in a standardized form for human or machine interpretation. It can be a static or dynamic model or a simulation representing reality. It can establish order, structure, grouping or classification.
03.00	Plan	A proposed scheme or systematic course of action for achieving a declared purpose. It predicts how to successfully accomplish objectives in terms of specific actions, undertaken at defined times and employing defined resources. It can apply to technical, project or enterprise actions. At a high level of abstraction, it can be a policy or, with reference to assets and their disposition, a strategy.
04.00	Procedure	A declared way of formally conducting a customary course of action. It defines an established and approved way or mode of conducting business in an organization. It can detail permissible or recommended methods, in order to achieve technical or managerial goals or outcomes.
05.00	Record	A permanent, readable form of data, information or knowledge. Accessible and maintained evidence of the existence or occurrence of facts, events or transactions. It can take the form of a journal chronicle, register or archive. It can contain the information required to confirm achievement of performance, fiscal or legal conditions or obligations.
06.00	Report	An account prepared for interested parties, in order to communicate status, results or outcomes. It is a result of information gathering, observation, investigation or assessments, and it can convey situation, affects, progress or achievement. It serves to inform, so that decisions or subsequent actions can be taken.
07.00	Request	A communication that initiates a defined course of action or change in order to fulfil a need. This can originate or control ongoing action, based on an agreed plan or procedure. It can result in a proposal or plan of action. It can take the form of a solicitation, requisition, instruction or demand for a resource, product, service or an approval to act.
08.00	Specification	Criterion or condition that places limits or restrictions on actions, attributes or qualities. It establishes measures or qualities for determining acceptability, conformity or merit. It can be required as part of an agreement or contract.

Each WP is prefixed by a reference number that indicates the WP and the standard within which it is defined. WPs from ISO/TR 25060 are preceded by "CIF". Those from ISO/IEC 15504-6[1)] are prefaced by a two-part WP ID from that document.

Output WPs are suffixed with the item number of the process outcome that creates or updates the WP.

In an iterative life cycle or for management activities, WPs are revised over time. WPs changed by a process appear in both the input and the output columns.

C.2.3 The process work product list

Table C.3 lists the WPs for each HCP process described in Clause 6 and associated with each of the processes described in this document. Two categories of WPs are listed for each process:

— Those that are used as input for the process ("input WPs"). This information is useful while executing the process.

1) Cancelled and replaced by ISO/IEC TS 33060:2020.

— those that are being produced by the process ("output WPs"). This is information that is produced or changed as a result of the execution of the process.

The final column of Table C.3 contains notes regarding particular human-centred issues for the WPs related to the system life cycle.

NOTE This document does not mandate that any particular grouping is used for reporting or documenting WPs.

Table C.3 — WPC

WP ID	WP name	WP typical characteristics related to HCD	Where to use in HCD PRM	Type of WP
01.03	**Competent personnel register**	— staff experience, skills, and knowledge — competence to perform life cycle processes — team working ability — staff assessments — training and education needs — retraining, reassignment or reallocation plans — recruitment criteria — project personnel profile	2.2	object or description
01.06	**Qualified operators**	— operator competence definition — operator selection criteria — training criteria — qualifications — operating instructions — failure detection instructions — authorization to operate — training resources — system training mode — service availability	4.1 Input for 4.2, 4.3	object
01.08	**Verified system**	— conformity evidence — configuration status — deviations — corrective actions	3.5.3	object

Table C.3 *(continued)*

WP ID	WP name	WP typical characteristics related to HCD	Where to use in HCD PRM	Type of WP
01.10	**Validated system**	— service requirements — operational site — qualified operators — service non-conformities — operational status — acceptance condition — usability evaluation report	3.5.3	object
01.11	**Operational system**	— service requirements — service availability — service life — service non-conformities — maintenance conditions — operators	4.1, 4.3 Input for 4.2	object
02.01	**Tailored system life cycle stage model**	— stage purpose — stage outcomes — enabling system services — succeeding stage criteria — stage exit criteria — approval to proceed	3.1.3	description
02.02	**Tailored system life cycle process model**	— process purpose — process outcome — activity identity and detail — output WPs — input WPs	3.1.4	description

Table C.3 *(continued)*

WP ID	WP name	WP typical characteristics related to HCD	Where to use in HCD PRM	Type of WP
02.03	**System life cycle stage model**	— business strategy — business area strategy — stages — gates — gate review achievement criteria — gate review authorities — system life cycle management policy and procedures — system life cycle performance measures — risk management policies and procedures	2.1	description
02.04	**System life cycle process model**	— policy to adapt system life cycle processes — life cycle process performance or trends — project requirements and needs — quality management policies and procedures	2.3	description
02.07	**Stakeholders' profile**	— stakeholder classes — stakeholder identity — acquirer organizations — supplier organizations — regulatory bodies — members of society — stakeholder representatives	3.2.1	description
02.08	**System functional model**	— product function — performance parameters — data flows — human-centred quality measures — functional views and viewpoints — modelling notation	3.4.1	description

Table C.3 *(continued)*

WP ID	WP name	WP typical characteristics related to HCD	Where to use in HCD PRM	Type of WP
02.09	**Architectural design description**	— system elements — structure views and viewpoints — non-functional views and viewpoints — design rationale — interface requirements — implementation technology — planned evolution — technology upgrades	3.4.2	description
03.01	**Acquisition strategy**	— acquisition plan — life cycle model — make, buy or reuse policy — supply chain relationships — market influences — technology investment strategy	1.2, 2.3 Input for 2.3	plan
03.02	**Supply strategy**	— enterprise objectives — business area objectives — asset base — resource availability — service offerings — product families	1.1, 1.2, 2.3 Input for 1.1, 1.2	plan
03.03	**Business strategy**	— new business opportunities — business areas — opportunity viability — risks to organization — projects prioritization — current product or service portfolio — current assets — resource availability — investment strategy	1.1 Input for 1.1, 1.2	plan

Table C.3 *(continued)*

WP ID	WP name	WP typical characteristics related to HCD	Where to use in HCD PRM	Type of WP
03.04	**System life cycle management policy**	— business achievement criteria — life cycle reference models — stage gate or milestones approval criteria — system life cycle processes improvement policy	1.2, 2.1 Input for 1.2, 2.1, 2.2	plan
03.06	**System life cycle process policy**	— system life cycle process definitions — life cycle reference models — process application policy — tailoring or adaptation policy	2.1, 2.2 Input for 2.2	plan
03.07	**Training strategy**	— competence profiles — knowledge — skills — experience — aptitude — recruitment — reassignment	2.2, 4.1 Input for 2.2, 4.2, 4.3	plan
03.08	**Quality management policy**	— business strategy — organization quality goals and objectives — quality management standards — participant recruiting policy — privacy protection policy or ethics policy for recruited participants — usability management policy — human-centred quality objectives	1.2, 2.1 Input for 2.1, 2.3	plan
03.09	**Project management plan**	— work breakdown structure — task relationships or external dependencies — achievement milestones — organizational infrastructure — procured items and services — project review times or events — reserves for risk management	3.1.3, 3.1.4	plan

Table C.3 *(continued)*

WP ID	WP name	WP typical characteristics related to HCD	Where to use in HCD PRM	Type of WP
03.10	**Project acquisition plan**	— staff recruitment — acquired materials and goods — acquired services — solicitation plans — supplier selection — contract monitoring schedule	3.1.4 Input for 4.1	plan
03.11	**Technical management plan**	— technical achievement criteria — technical roles and responsibilities — technical resources — selected methods and tools — supporting technical services — technology readiness — technical risks — technical review schedule	2.1, 2.2, 3.1.3 Input for 3.1.4, 3.1.5, 3.4.2	plan
03.12	**Service management plan**	— agreement — service levels — service conditions — operational location — service non-conformities — maintenance — operator training	4.1 Input for 4.2	plan

Table C.3 *(continued)*

WP ID	WP name	WP typical characteristics related to HCD	Where to use in HCD PRM	Type of WP
03.13	**Project quality plan**	— project quality objectives — enterprise quality goals and objectives — enterprise quality management policies and procedures — quality standards — infrastructure assets and capability — enabling systems — infrastructure capacity — service availability — allocation of tasks — project performance criteria — stakeholder satisfaction criteria — project status reporting schedule — enterprise reporting schedule	3.1.4	plan
03.14	**Decision-making strategy**	— decision categories — prioritization scheme — effectiveness assessment — project initiation or progression approvals — decision-making parties	3.1.2	plan
03.15	**Risk management strategy**	— risk avoidance actions and rationale — risk mitigation actions and rationale — risk transfer actions and rationale — risk retention actions and rationale	3.1.2	plan
03.19	**Integration strategy**	— assembly sequence and configurations — verification information — fault isolation and diagnosis constraints — operator integration	4.1	plan

Table C.3 *(continued)*

WP ID	WP name	WP typical characteristics related to HCD	Where to use in HCD PRM	Type of WP
03.20	**Verification strategy**	— user requirements (and HCD-related requirements) — verification methods and techniques — configuration sequences — disassembly strategies — fault diagnosis steps — inspections and comparisons — static and dynamic tests — demonstrations and acceptance criteria — regression criteria — verification enabling systems requirements — non-conformity handling — reviews and audits	3.1.3 Input for 3.5.1, 3.5.2	plan
03.21	**Transition strategy**	— installation constraints — operating environment dependencies — commissioning instructions — operator incorporation — acceptance conditions	4.1	plan
03.22	**Validation strategy**	— stakeholder requirements or acquirer agreements — safety, technical and commercial criticality constraints — validation enabling system requirements — non-conformity handling — validation limitations and deferred actions — service conformity recording — validation steps — operational states, scenarios and missions — conformity confidence, diagnosis and discrepancies — validation methods and techniques — purpose, conditions and conformity criteria	3.1.3 Input for 3.5.1, 3.5.2	plan

Table C.3 *(continued)*

WP ID	WP name	WP typical characteristics related to HCD	Where to use in HCD PRM	Type of WP
03.23	**Operation strategy**	— service availability schedule — introduction to service conditions — operator capacity and renewal — system modification schedules — release and reacceptance criteria — service withdrawal circumstances — service migration and concurrent services — customer satisfaction criteria	4.2	plan
03.24	**Maintenance strategy**	— operational availability requirements — corrective and preventative maintenance policy — maintenance capabilities and locations — maintenance enabling system requirements — maintenance staff competence — maintenance schedules — service restrictions and suspensions — replacement system element logistics — health, safety, security and environment legislation	4.2	plan
03.25	**Disposal strategy**	— waste product handling — system element recycling options — disposal enabling system requirements — disposal constraints, regulations and directives — disposed material handling — audits and inspections — health, safety, security and environment legislation	4.3	plan
04.01	**Supplier selection procedure**	— business policy — supply chain circumstances — technical and commercial issues — selection rating criteria — negotiation schedules — decision and rationale feedback	2.3	procedure