
**Ergonomics of human-system
interaction —**

**Part 220:
Processes for enabling, executing
and assessing human-centred design
within organizations**

Ergonomie de l'interaction homme-système —

*Partie 220: Processus de validation, d'exécution et d'évaluation de la
conception centrée sur l'opérateur humain au sein des organisations*





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Foreword

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

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 documents 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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

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

This first edition of ISO 9241-220 cancels and replaces ISO/TR 18529:2000.

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 describes processes that represent good practice for human-centred design within and across projects. Human-centred design is an approach to system design and development that aims to improve usability, accessibility and user experience and avoid harm from use, by focussing on the use of the system.

The primary intended users of this document are professionals responsible for institutionalising human-centred design in an organization, who need to specify, assess and improve human-centred design in the organization. This application needs the clear and consistent structure that is provided by process definitions, as described in ISO/IEC TR 24774. For an introduction to human-centred design, see ISO 9241-210 (described below).

Process models were developed to provide:

- the potential to analyse the ability of an organization to deliver and/or maintain a system that meets a required level of performance and quality;
- a description of the factors that hinder this ability; and
- a means of addressing such shortcomings and mitigating associated risks of adverse consequences.

These have led to the widespread adoption of process modelling and assessment as an element in the assurance of timely and effective system delivery. Processes are defined at the level of **what** is done to develop and operate a system or organization.

The processes in this document represent good practice in human-centred design from a range of industries. They are described from the perspective of those who analyse, design and evaluate the human use of interactive systems. This includes associated requirements for project management and top management support for human-centred design.

This document uses the same structured format as other International Standards for process models (such as ISO/IEC/IEEE 12207 and ISO/IEC/IEEE 15288). ISO/IEC/IEEE 12207 refers to this document for information on human-centred design and usability.

Human-centred design aims to achieve required levels of human-centred quality. In this document, human-centred quality is the collective term used to refer to usability, accessibility, user experience, and avoidance of harm from use (see [Annex E](#)).

This document can be used to:

- implement human-centred design as part of a system development or procurement process and/or support life cycle;
- assess an enterprise's existing capability to carry out the human-centred processes;
- improve the application of human-centred design as part of an existing system development process;
- develop competence in human-centred design.

For executives/top management, this document gives guidance on governance in the area of human-centred quality. Use of this guidance gives confidence that interactive systems developed and used by an organization are usable and accessible.

For managers, this document facilitates integration of human-centred design into the system life cycle and quality management system. Human-centred activities can be specified, assessed and improved as required for projects.

This document enables efficient interaction between human-centred design and other disciplines. The services and information that human-centred design staff provide to projects are defined so that their value and purpose can be understood.

Relationship to ISO 9241-210

ISO 9241-210 describes the principles of a human-centred approach and the activities necessary for human-centred design of an interactive system. Conformance is achieved by carrying out all the required activities and those recommended activities that are identified as being relevant. ISO 9241-210 describes HCD activities in less detail than this document and can be used to provide an overview of a project's basic capabilities in human-centred design.

This document extends the model in ISO 9241-210, and elaborates the principles and activities as structured processes with defined outcomes for the execution of human-centred design within a project.

[Annex C](#) identifies the specific aspects of the processes in this document that are associated with the requirements and recommendations in ISO 9241-210 by mapping between them. Application of relevant HCD processes as described in document can be used as a means of showing conformance to ISO 9241-210. The extra detail can provide a basis for organizational improvements in human-centred design where any non-compliances are identified.

Ergonomics of human-system interaction —

Part 220:

Processes for enabling, executing and assessing human-centred design within organizations

1 Scope

This document describes the processes and specifies the outcomes by which human-centred design (HCD) is carried out within organizations. Human-centred design aims to meet requirements for human-centred quality (see [Annex E](#)) throughout the life cycle of interactive systems. The processes are described from the viewpoint of those responsible for the analysis, design and evaluation of the human use of interactive systems. The process descriptions include the purpose, benefits, outcomes, typical activities and work products for each process, and are for use in the specification, implementation, assessment and improvement of the activities used for human-centred design and operation in any type of system life cycle. They can also provide the basis for professional development and certification.

The processes are associated with the domains of ergonomics/human factors, human-computer interaction, usability and user experience. This document does not include specific methods for human-centred design, nor does it describe processes for organizational redesign.

The scope of this document does not include other aspects of ergonomics, which include the design of organizations as well as systems for human use, and which extend beyond the domain of design; for example in the forensic analysis of the causes of accidents and in the generation of data and methods of measurement.

NOTE 1 ISO/TS 18152 is a related standard with a broader scope than this document. It includes the organizational processes for the identification and handling of issues related to both users and other stakeholders.

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 2 Human-centred design 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 compliance with the ISO/IEC 33000 family of standards.

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.

Copyright release for the process descriptions

Users of this document may freely reproduce the process descriptions contained in [Clause 9](#) as part of any process assessment model, or as part of any demonstration of compatibility with this document, so that it can be used for its intended purpose.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1 accessibility

extent to which products, systems, services, environments and facilities can be used by people from a population with the widest range of user needs, characteristics and capabilities to achieve identified goals in identified contexts of use

Note 1 to entry: Context of use includes direct use or use supported by assistive technologies.

[SOURCE: ISO 9241-112:2017, 3.15]

3.2 context of use

combination of users, goals and tasks, resources, and environment

Note 1 to entry: The “environment” in a context of use includes the technical, physical, social, cultural and organizational environments.

Note 2 to entry: This can apply to an existing context of use or an intended context of use.

[SOURCE: ISO 9241-11:2018, 3.1.15, modified — Note 2 to entry has been added.]

3.3 decomposition

breaking of a complex problem or system into smaller parts that are more manageable and easier to understand

3.4 effectiveness

accuracy and completeness with which users achieve specified goals

[SOURCE: ISO 9241-11:2018, 3.1.12]

3.5 efficiency

resources used in relation to the results achieved

Note 1 to entry: Typical resources include time, human effort, costs and materials.

[SOURCE: ISO 9241-11:2018, 3.1.13]

3.6 enterprise

that part of an organization with responsibility to acquire and to supply products and/or services according to agreements

Note 1 to entry: An organization may be involved in several enterprises, and an enterprise may involve one or more organizations.

[SOURCE: ISO/TS 18152:2010, 4.4]

3.7

ergonomics

human factors

scientific discipline concerned with the understanding of interactions among human and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance

[SOURCE: ISO 26800:2011, 2.2, modified — The Note has been omitted.]

3.8

evaluation

systematic determination of the extent to which an entity meets its specified criteria

[SOURCE: ISO/IEC 25041:2012]

3.9

goal

intended outcome

[SOURCE: ISO 9241-11:2018, 3.1.10]

3.10

harm from use

negative consequences regarding health, safety, finances or the environment that result from use of the system

Note 1 to entry: The negative consequences can be for the user or for any other stakeholder.

Note 2 to entry: Although avoidance of harm from use, i.e. eliminating any exposure of risk that poses a potential harm, cannot be achieved completely, designing an interactive system can aim at mitigating risks to an acceptable minimum (see [Annex E](#)).

[SOURCE: ISO 9241-11:2018, 3.2.4, modified — Note 2 to entry has been added.]

3.11

human-centred design

HCD

approach to system design and development that aims to make interactive systems more usable by focussing on the use of the system; applying human factors, ergonomics and usability knowledge and techniques

Note 1 to entry: The term “human-centred design” is used rather than “user-centred design” in order to emphasize that this document also addresses impacts on a number of stakeholders, not just those typically considered as users. However, in practice, these terms are often used synonymously.

Note 2 to entry: The objectives of human-centred design include identification of the technical functionality that is a prerequisite for human-centred quality.

Note 3 to entry: In this document, “human-centred design” is used as a noun phrase, and “HCD” as an adjective phrase.

[SOURCE: ISO 9241-210:2010, 2.7, modified — Note 2 to entry has been replaced and Note 3 to entry has been added.]

3.12

human-centred quality

extent to which requirements for usability, accessibility, user experience and avoidance of harm from use are met

Note 1 to entry: Provision of the necessary technical functionality is a prerequisite for human-centred quality.

Note 2 to entry: Usability, accessibility, user experience and avoidance of harm from use can only be managed to the extent that they can be controlled by designed aspects of the interactive system.

Note 3 to entry: Human-centred quality is a collective term for the intended outcomes of interaction of the user with the system.

3.13

human-centred quality objective

objective for the design of an interactive system facilitating achievement of intended outcomes with appropriate usability, accessibility, user experience and avoidance of harm from use arising from the use of the system

Note 1 to entry: Human-centred quality objectives are statements of outcomes to be achieved for the users of the system in general. They are often provided by the sponsor of the system taking the perspective of its future users.

3.14

human factors data

information about humans and human behaviour

Note 1 to entry: This includes existing knowledge or new user related research. For example, anthropometric data, health and safety data, psychometric measurements, ergonomics standards, accessibility standards, and expert knowledge in human sciences (e.g. psychology, sociology, medicine, human computer interaction, behavioural science, anthropology, management science, education, personnel and staffing management), and codifications of this information and knowledge (e.g. international standards, legislative requirements, existing patents, good practice, style guides and project standards) as appropriate.

3.15

inspection-based evaluation

evaluation based on the judgment of one or more evaluator(s) who examine or use a system to identify potential usability problems and/or deviations from established criteria

Note 1 to entry: Established criteria typically include user requirements, usability guidelines in standards, design conventions contained in manufacturer guidelines and style guides, task models to be supported as well as standardized principles.

Note 2 to entry: Inspection-based evaluation is a generic term for methods that include, but are not limited to, heuristic evaluation, cognitive walkthroughs, standards inspection, pluralistic walkthroughs, and consistency inspections.

[SOURCE: ISO/IEC 25066:2016, 3.10, modified — Notes to entry 1, 3 and 5 were deleted and the remaining Notes renumbered.]

3.16

interaction object

<interactive system> control or component (including information) assisting the user in achieving specified goals using an interactive system

3.17

interactive system

combination of hardware and/or software and/or services and/or people that users interact with in order to achieve specific goals

Note 1 to entry: This includes, where appropriate, packaging, user documentation, on-line and human help, support and training.

[SOURCE: ISO 9241-11:2018, 3.1.5]

3.18

life cycle

evolution of a system, product, service, project or other human-made entity from conception through retirement

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.23]

3.19**process**

set of interrelated or interacting activities that use inputs to deliver an intended result

[SOURCE: ISO 9000:2015, 3.4.1]

3.20**process activity**

activity that, when consistently performed, contributes to achieving a specific process purpose

Note 1 to entry: In ISO/IEC 33001:2015 this is called a base practice.

Note 2 to entry: For some process activities, the need for the performance of the activity will depend on the project context.

3.21**process assessment**

disciplined evaluation of an organization's processes against a process assessment model

[SOURCE: ISO/IEC 33001:2015, 3.2.15]

3.22**process benefit**

positive achievement from the execution of a process

Note 1 to entry: Benefits are often spread broadly across the business and not necessarily related to the technical or business intent of executing a process.

Note 2 to entry: A benefit can provide the motivation to execute a process, but it may not be the primary reason to do so.

3.23**process capability**

capability of a process to meet its purpose as managed by an organization's management and process definition structures

Note 1 to entry: This usage differs from human capability, military capability and operational capability.

Note 2 to entry: Process capability levels are described in ISO/IEC 33002.

3.24**process category**

set of processes addressing the same general area of activity

[SOURCE: ISO/TS 18152:2010, 4.15]

3.25**process improvement**

set of actions taken to improve the quality of the organization's processes aligned with the business needs and the needs of other concerned parties

[SOURCE: ISO/IEC 33001:2015, 3.1.7, modified — The words "set of" have been added to the definition.]

3.26**process outcome**

observable result of the successful achievement of the process purpose

[SOURCE: ISO/IEC/IEEE 12207:2017, 3.1.34]

3.27

process purpose

high level objective of performing the process and the likely outcomes of effective implementation of the process

Note 1 to entry: The implementation of the process is to provide benefits to the stakeholders.

[SOURCE: ISO/IEC/IEEE 12207:2017, 3.1.35]

3.28

project

endeavour with defined start and finish criteria undertaken to create a product or service in accordance with specified resources and requirements

Note 1 to entry: The term “project” is not intended to be exclusive to the development of a system. Projects include long-term activities related to a system, such as training, maintenance and support.

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.33, modified — Note 1 to entry has been changed.]

3.29

prototype

<interactive system> representation of all or part of an interactive system, that, although limited in some way, can be used for analysis, design and evaluation

Note 1 to entry: A prototype can be as simple as a sketch or static mock-up or as complicated as a fully functioning interactive system with more or less complete functionality.

[SOURCE: ISO 9241-210:2010, 2.9]

3.30

requirement

condition or capability that must be met or possessed by a system, system component, product, or service to satisfy an agreement, standard, specification, or other formally imposed documents

[SOURCE: ISO/IEC/IEEE 24765:2017, 3.3431 meaning 2, modified — The Note and the Example have been deleted.]

3.31

risk

effect of uncertainty on objectives

Note 1 to entry: An effect is a deviation from the expected — positive and/or negative.

Note 2 to entry: Objectives can have different aspects (such as financial, health and safety, and environmental goals) and can apply at different levels (such as strategic, organization-wide, project, product and process).

Note 3 to entry: Risk is often characterized by reference to potential events and consequences, or a combination of these.

Note 4 to entry: Risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated likelihood of occurrence.

Note 5 to entry: Uncertainty is the state, even partial, of deficiency of information related to, understanding or knowledge of an event, its consequence, or likelihood.

[SOURCE: ISO Guide 73:2009, 1.1]

3.32**satisfaction**

extent to which the user's physical, cognitive and emotional responses that result from the use of a system, product or service meet the user's needs and expectations

Note 1 to entry: Satisfaction includes the extent to which the user experience that results from actual use meets the user's needs and expectations.

Note 2 to entry: Anticipated use can influence satisfaction with actual use.

[SOURCE: ISO 9241-11:2018, 3.1.14]

3.33**service**

means of delivering value for the customer by facilitating outcomes the customer wants to achieve

Note 1 to entry: Services can include both human-system interactions (e.g. accessing a word processor through the web) and human-human interactions (e.g. a citizen interacting with a clerk at the post office counter).

Note 2 to entry: The "customer" is a user, and does not necessarily have a financial relationship.

[SOURCE: ISO/IEC 20000-1:2018, 3.2.15, modified — The Notes to entry have been replaced.]

3.34**stakeholder**

person or organization that can affect, be affected by, or perceive themselves to be affected by a decision or activity

Note 1 to entry: Stakeholders can include: users, systems owners or managers and people who are indirectly affected by the operation of a system, product or service.

Note 2 to entry: Different stakeholders can have different expectations, needs, or requirements.

[SOURCE: ISO 31000:2018, 3.3, modified — Note 1 to entry has been replaced and Note 2 to entry has been added.]

3.35**system**

combination of interacting elements organized to achieve one or more stated purposes

Note 1 to entry: A system is sometimes considered as a product or as the services it provides.

Note 2 to entry: A complete system includes all of the associated equipment, facilities, material, computer programs, firmware, technical documentation, services and personnel required for operations and support to the degree necessary for self-sufficient use in its intended environment.

Note 3 to entry: A system can be composed of a product, service, built environment or combination thereof, and people.

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.46, modified — Note 2 has been replaced and Note 3 added.]

3.36**task**

set of activities undertaken in order to achieve a specific goal

Note 1 to entry: These activities can be physical, perceptual and/or cognitive.

Note 2 to entry: While goals are independent of the means used to achieve them, tasks describe particular means of achieving goals.

[SOURCE: ISO 9241-11:2018, 3.1.11]

3.37

usability

extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use

Note 1 to entry: The "specified" users, goals and context of use refer to the particular combination of users, goals and context of use for which usability is being considered.

Note 2 to entry: The term "usability" is often used as a qualifier to refer to the knowledge, competencies, activities and design attributes that contribute to usability, such as usability expertise, usability professional, usability engineering, usability method, usability evaluation, usability heuristic.

[SOURCE: ISO 9241-11:2018]

3.38

user

person who interacts with a system, product or service

Note 1 to entry: Users of a system, product or service include people who operate the system, people who make use of the output of the system and people who support the system (including maintenance and training).

[SOURCE: ISO 26800:2011, 2.10, modified — Note 1 to entry has been replaced and Note 2 has been removed.]

3.39

user-based evaluation

evaluation that involves representative users performing tasks with the system to enable identification of human-centred quality problems and/or measurements of efficiency, effectiveness, user satisfaction or other user experiences

[SOURCE: ISO/IEC 25066:2016, 3.22, modified — "Usability" has been replaced by "human-centred quality."]

3.40

user experience

user's perceptions and responses that result from the use and/or anticipated use of a system, product or service

Note 1 to entry: User's perceptions and responses include the user's emotions, beliefs, preferences, perceptions, comfort, behaviours, and accomplishments that occur before, during and after use.

Note 2 to entry: User experience is a consequence of brand image, presentation, functionality, system performance, interactive behaviour, and assistive capabilities of a system, product or service. It also results from the user's internal and physical state resulting from prior experiences, attitudes, skills and personality; and from the context of use.

Note 3 to entry: The term "user experience" can also be used to refer to competence or processes such as user experience professional, user experience design, user experience method, user experience evaluation, user experience research, user experience department.

Note 4 to entry: Human-centred design can only manage those aspects of user experience that result from designed aspects of the interactive system.

[SOURCE: ISO 9241-210:2010, 2.15, modified — The definition has been reworded for clarification, Note 3 to entry has been replaced and Note 4 to entry has been added.]

3.41

user group

subset of intended users who are differentiated from other intended users by characteristics of the users, tasks or environments that could influence usability

[SOURCE: ISO 9241-11:2018 3.1.8]

3.42**user interaction**

exchange of information between a user and an interactive system via the user interface to complete the intended task

Note 1 to entry: User interaction is specified in a user interaction specification. This work product focuses on user interactions without considering implementation details. (see ref. CIF7 in [A.2.2](#)).

[SOURCE: ISO/IEC TR 25060:2010, 2.22, modified — Note 1 has been deleted.]

3.43**user interface**

set of all the components of an interactive system (software or hardware) that provide information and controls for the user to accomplish specific tasks with the interactive system

[SOURCE: ISO 9241-110:2006, 3.9, modified — The words "set of" have been added to the definition.]

3.44**user interface design guidance**

principle, requirement, recommendation or established convention for designing the user interaction and/or the user interface

Note 1 to entry: Specific requirements, recommendations or established conventions are also referred to as "user interface guidelines".

Note 2 to entry: Principles, requirements and recommendations are published in various sources including the ISO 9241 series and apply across user interface platforms.

Note 3 to entry: "Established conventions" include rules published by suppliers of the user interface platforms such as "Windows" or "Mac OS".

3.45**user need**

prerequisite identified as necessary for a user, or a set of users, to achieve an intended outcome, implied or stated within a specific context of use

EXAMPLE 1 A presenter (user) needs to know how much time is left (prerequisite) in order to complete the presentation in time (intended outcome) during a presentation with a fixed time limit (context of use).

EXAMPLE 2 An account manager (user) needs to know the number of invoices received and their amounts (prerequisite), in order to complete the daily accounting log (intended outcome) as part of monitoring the cash flow (context of use).

Note 1 to entry: A user need is independent of any proposed solution for that need.

Note 2 to entry: User needs are identified based on various approaches including interviews with users, observations, surveys, evaluations, expert analysis, etc.

Note 3 to entry: User needs often represent gaps (or discrepancies) between what should be and what is.

Note 4 to entry: User needs are transformed into user requirements considering the context of use, user priorities, trade-offs with other system requirements and constraints

[SOURCE: ISO/IEC 25064:2013, 4.18]

3.46**user requirements**

set of requirements for use that provide the basis for design and evaluation of interactive systems to meet identified user needs

Note 1 to entry: User requirements are derived from user needs and capabilities so that the user can use the system with acceptable usability, accessibility, user experience and avoidance of harm from use.

Note 2 to entry: User requirements are not requirements on the users.

Note 3 to entry: In software engineering terms, user requirements include both “functional” and “non-functional” requirements derived from user needs and capabilities.

[SOURCE: ISO/IEC TR 25060:2010, 2.21, modified — The words “set of” have been added to the definition and the Notes to entry have been replaced.]

3.47

validation

confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled

Note 1 to entry: A system is able to accomplish its intended use, goals and objectives (i.e., meet stakeholder requirements) in the intended operational environment. The right system was built.

Note 2 to entry: Human-centred quality objective can be evaluated as part of validation of an interactive system.

[SOURCE: ISO 9000:2015, 3.8.13, modified — Note 2 to entry has been added.]

3.48

verification

confirmation, through the provision of objective evidence, that specified requirements have been fulfilled

Note 1 to entry: Verification is a set of activities that compares a system or system element against the required characteristics. This includes, but is not limited to, specified requirements, design description and the system itself. The system was built right.

[SOURCE: ISO 9000:2015, 3.8.12]

3.49

work product

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: ISO/IEC 20246:2017, 3.20, modified — The Note has been replaced.]

4 Abbreviated terms

The following abbreviations are used in this document.

HCD human-centred design

HCP human-centred process

KPI key performance indicator

5 Conformance

To conform to this document a project or organization shall demonstrate that it has successfully applied a set of the processes in this document. Assessment of the successful performance of the applied processes shall use the process outcomes as evidence. This may be supported by evidence that relevant activities have been performed and relevant work products have been produced.

There are three ways of applying the processes in this document.

- 1) Applying all processes defined in this document. In this case, conformance means meeting all outcomes of all processes.
- 2) Applying a selected set of processes that are relevant to the project or organizational context. In this case, conformance means both justifying the selection of processes and meeting all outcomes of the declared set of processes.
- 3) Adapting processes to apply the process purpose to a different context or domain (e.g. if not applying processes to interactive systems). This is known as “tailoring” (see [Annex B](#)). In this case, conformance means meeting the declared outcomes of a declared set of processes.

A demonstration of conformance shall therefore:

- a) declare the set of processes for which conformance is claimed;
- b) provide a justification of omission for each process that is omitted;
- c) describe any tailoring of processes and work products (following the requirements of [Annex B](#));
- d) provide evidence of meeting the outcomes of the applied processes.

Assessment of process application is usually carried out by a process capability assessment. In this case, the requirements in the relevant parts of the ISO/IEC 33000 family of standards can be applied.

NOTE Other International Standards present human-centred design in different ways and have different means of demonstrating conformance. [Clause C.3](#) describes how conformance to these standards is assessed.

6 Purpose and benefits of this document

6.1 Purpose of human-centred design

Using a human-centred approach to the design and development of interactive systems has substantial economic and social benefits for users, employers and suppliers, as they tend to be more successful both technically and commercially. In some areas, for example consumer products, purchasers will pay a premium for well-designed products and systems.

A human-centred approach to design, as described in this document, improves user engagement with a project and with the result. Defining HCD processes supports better integration of the HCD practitioner with the project team. It provides a competence definition for usability professionals and an improvement framework for organizations wishing to adopt a human-centred approach to development.

Human-centred design can help achieve and sustain an interactive system that meets defined requirements for human-centred quality (usability, accessibility, user experience and avoidance of harm from use) for users and other stakeholders. The examples below illustrate some of these benefits.

Examples of benefits related to usability:

- increasing the performance of users and the operational efficiency of organizations;
- being easier to understand and use, thus reducing training and support costs;
- improving user satisfaction.

Examples of benefits related to accessibility:

- increasing the size of the potential market by designing for greater diversity;
- increasing usability for people with a wider range of capabilities and thus increasing accessibility;

- avoiding high staff costs resulting from inadequate accessibility.

Examples of benefits related to user experience:

- ease of introduction of a change to a major system into an organization;
- enhanced job satisfaction through feeling in control, with a sense of autonomy;
- sense of familiarity across products from the same manufacturer;
- competitive advantage, for example by improving brand image.

Examples of benefits related to avoiding harm from use:

- increased safety and security for employees using corporate systems;
- enhanced wellbeing through reduced discomfort and stress when using the product;
- avoiding unnecessary expenditure resulting from use errors.

6.2 Purpose of HCD process descriptions

This document describes the processes that represent good practice for implementing human-centred design within and across projects, and for assessing an organization's capability to implement and operate HCD processes. The processes can be applied by small- and medium-sized enterprises as well as by large organizations. See [8.1](#) for examples of the use of the process descriptions.

The processes in [Clause 9](#) describe human-centred design within a project, and provide a starting point for human-centred design. HCP.1, HCP.2 and HCP.4 describe the processes that enable human-centred design within organizations and life cycles. HCP.3 describes the execution of human-centred design within a project.

[Annex D](#) explains the uses of this document in more detail. For some of the applications listed in [Annex D](#), only a subset of the processes described in this document may be used.

6.3 Benefits of using HCD process descriptions

HCD process descriptions provide a level of detail that allows human-centred design to be implemented in a wide range of applications (e.g. for different types of system and life cycle). They describe what is achieved by the process (the purpose and outcomes), as well as how they are performed (the activities). This facilitates their integration, and application and management in a project or organizational context, for example by providing a basis for the selection of methods and techniques. [Clause 7](#) explains the model that provides a framework for the process descriptions.

7 HCD processes

7.1 HCD process model

This document describes a process model for human-centred design. The four HCD processes categories shown in [Figure 1](#) are associated with different areas of responsibility, that are necessary in order to address human-centred quality in interactive systems, as described in [Clause 6](#). The first two categories deal with responsibilities for the processes involved in the management of human-centred design. The third and fourth categories deal with responsibility for the processes necessary to deliver human-centred quality in design projects and in the operation of interactive systems. Each process describes the activities and outcomes involved.

Ensure enterprise focus on human - centred quality (HCP 1) Vision and policies are set across the enterprise	Strategy
Enable human - centred design across projects and systems (HCP 2) Defined processes, guidelines, methods, tools and qualified roles are in place across projects	Organizational infrastructure
Execute human - centred design within a project (HCP 3) Process outputs are produced with appropriate quality: <ul style="list-style-type: none"> • Context of use is identified • User needs are identified • User requirements are specified • User-system interaction is specified • Prototypes are produced • Evaluation results are available 	Project
Introduction, operation and end of life of the system (HCP 4) <ul style="list-style-type: none"> • Transition into operation is managed • Feedback on the operation is obtained • Operation of the system is supported • Changes in context of use are identified • System continues to satisfy user needs throughout its lifecycle 	Operation

Figure 1 — HCD processes

[Figure 1](#) summarizes the HCD process categories and illustrates the different levels in an organization and their responsibilities for human-centred quality. 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 human-centred design (HCP.1). Human-centred design across projects and systems is enabled by those responsible for (project) program management and/or the operation of systems (HCP.2). The execution of human-centred design within projects and the introduction, operation and end of life of systems is carried out by people with the necessary competence [see [Table 11](#), Process outcome i)] 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.

NOTE [Table 1](#) lists the primary audiences for each process category.

7.2 HCD processes

The HCD processes (HCPs) are listed in [Table 1](#). They are grouped into the following process categories:

- HCP.1: Ensure enterprise focus on human-centred quality;
- HCP.2: Enable human-centred design across projects and systems;
- HCP.3: Execute human-centred design within a project;
- HCP.4: Introduction, operation and end of life of a system.

The process categories HCP.1, HCP.2, HCP.3 and HCP.4 are described in [9.2](#), [9.3](#), [9.4](#) and [9.5](#).

[Table 1](#) also lists the primary audiences for each process category (See [Table F.1](#) for the types of organizational threat addressed by each process category).

NOTE The HCD processes and their descriptions can also be used for education and training.

In HCP.1, HCP.2 and HCP.4, each process is identified with a reference number of the form HCP.x.y where “HCP” is an abbreviation for Human-Centred Process. In HCP.3 the processes are decomposed into sub-processes, and each sub-process is identified with a reference number of the form HCP.x.y.z. The term process is used at all sub-levels of decomposition of the process descriptions. However, for any given process category, processes are only fully described at the lowest level of decomposition.

HCP.1 addresses what organizations need to do to support human-centred design. HCP.2 describes the management of human-centred design within the organization, and HCP.3 details the technical aspects of human-centred design during development or change of a system. HCP.4 covers the introduction and operation of a system. Together, the implementation of these four sets of processes can ensure that the systems produced, acquired and operated by an organization meet requirements for human-centred quality. Organizations can implement these processes to the degree of rigour necessary to achieve required human-centred quality. Individual processes can be applied without the necessity to have all processes in place, and the sequence of implementing and applying them depends on the situation in which they are used.

The purpose of each process is to produce the specified outcomes. However, to assist in the correct implementation as well as the assessment of process performance, the description of each process includes a list of the process activities that are typically carried out to achieve the process outcomes. [Annex A](#) describes the work products that are used.

HCP.3, which describes the processes for executing human-centred design within projects, elaborates on the content of ISO 9241-210 and has a similar scope. It describes the planning and management of human-centred design for a project as well as detailed HCD activities.

NOTE The relationship between the names of the processes in ISO 9241-210 and the names of the HCP.3 processes is explained in [Table 7](#).

HCP.3 is decomposed into sub-processes because it covers the core technical processes of human-centred design and the outcomes and activities for implementing human-centred design within a project are better established. The other processes cover issues that are not within the scope of ISO 9241-210. HCP.1 and HCP.2 describe the organizational governance and high-level management activities that require and resource human-centred design. HCP.4 describes the activities that ensure that human-system issues are addressed throughout the life of a system.

Table 1 — HCD processes

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 human-centred design. 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	

Table 1 (continued)

Unique Identifier	Process Name	Primary audiences
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	

7.3 Relationships between the HCD processes

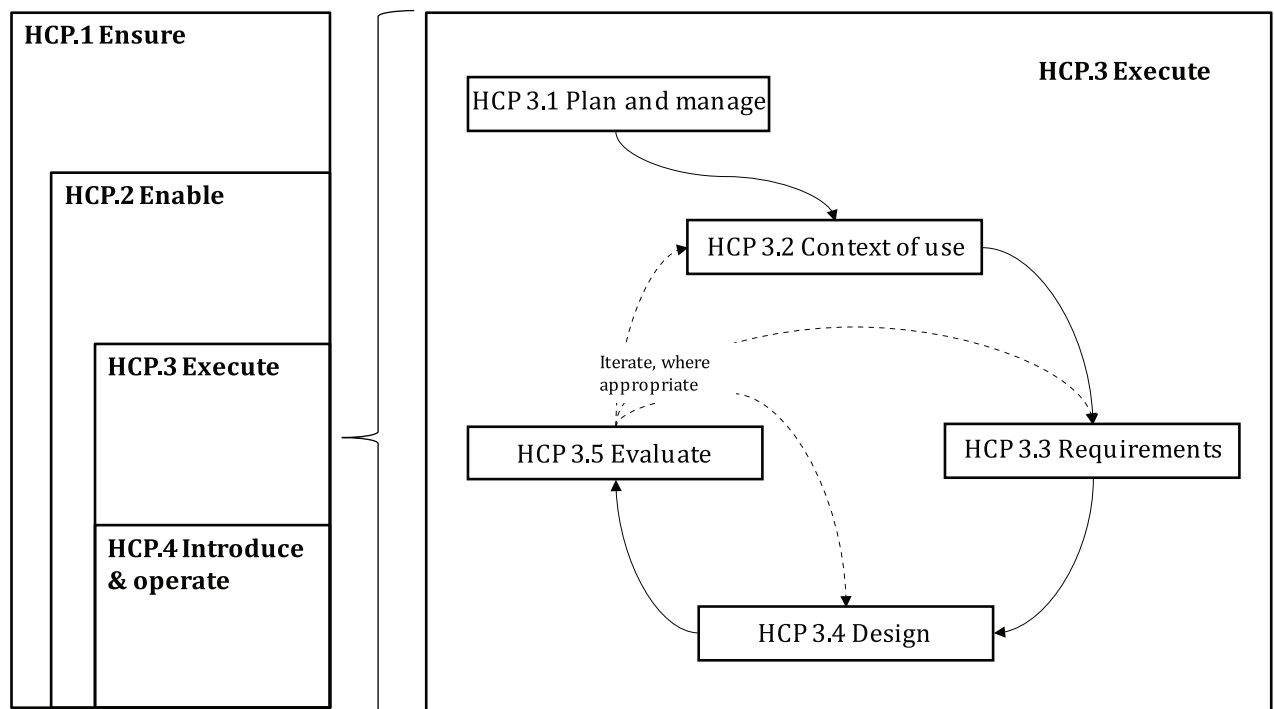


Figure 2 — Relationships between the HCD processes (including the sub-processes in HCP.3)

The nested relationship of HCP.1, 2, 3 and 4 indicates management control and responsibility. HCP.1 is responsible for HCP.2, which is responsible for HCP.3 for each project.

For each project, HCP.3.1 is responsible for the application of the technical processes (HCP.3.2, HCP.3.3, HCP.3.4 and HCP.3.5), as well as the early application of the processes in HCP.4 in order to elicit requirements for the introduction, operation and end of life of a system.

The elaboration of HCP.3 has lines joining the boxes indicating exchange of technical information. An arrowhead on these lines indicates the direction of exchange of a technical work product, such as a set of requirements or an evaluation report. The box for HCP.3.1 is set outside a loop comprised of the other four process boxes and has a line to the loop indicating its control of the technical processes in a project.

The technical processes are typically used iteratively in a project. This is shown by lines and arrows joining the four processes (HCP.3.2 to HCP.3.3 to HCP.3.4 to HCP.3.5) in a loop. Evaluation can result in iteration back to any of HCP.3.2 to 3.4 to extend understanding of the context of use, detailing of the requirements or revision of the design. This is shown by dotted lines back to these boxes.

Evaluation should also take place as part of HCP.4. The results of use of the system provide feedback on whether HCP.1 has been successful as well as identifying any need for re-development of the interactive system, e.g. from a changed context of use.

8 Using the HCD process descriptions

8.1 Uses of the process descriptions

8.1.1 General

This subclause describes how the HCD processes can be used to:

- provide a basis for implementing human-centred design as part of a system development or procurement process and/or support life cycle;
- assess an enterprise's capability to carry out the human-centred processes based on the extent to which the processes have been applied in previous projects;
- improve the application of human-centred design based on identifying gaps between the existing and desired levels of performance of each HCD process;
- provide the basis for the definition of professional competence for HCD professionals.

These applications are summarized below, and described in more detail in [Annex D](#).

8.1.2 Implementing human-centred design as part of a system development or procurement process and/or support life cycle

The HCD processes can be used as a basis for incorporating HCD activities into a system development or procurement process by enterprises (organizations, departments or projects) and/or into a support life cycle that needs to be human-centred.

In this application, the enterprise identifies which HCD processes help to meet its organizational needs, and the capability required to achieve the enterprise's business purposes. The detailed description of process work products in [Annex A](#) and the information management procedure described in [B.3](#) can assist in this definition. This typically takes place as part of improvement (see [8.1.4](#)) after assessment (see [8.1.3](#)).

8.1.3 Assessing an enterprise's existing capability to carry out the human-centred processes

This document can be used in the assessment of an enterprise's capability to carry out the human-centred processes that it describes and, hence, achieve acceptable human-centred quality in the

interactive systems that it produces or acquires. [Clause 4](#) provides the requirements for a conformant assessment.

In this application, the first step is the scoping of the model for the assessment. This consists of the selection of relevant processes and the definition of the maximum capability that the organization aspires to. If an organization wants to gain an overview of its capability in relation to human-centred design, it assesses all processes. If an organization wants to assure particular capabilities, then processes with outcomes related to that capability are assessed. The next step is to select typical projects for assessment. Assessments vary in their degree of rigour. For a thorough assessment, a range of projects is selected to be representative of the spread of work, size of project and diligence of the enterprise.

The assessment is typically achieved by interviewing selected staff, to ascertain how well the outcomes of the processes are achieved. The work products listed in [Annex A](#) can be used as evidence of the performance of the activities.

8.1.4 Improving the application of human-centred design as part of an existing system development process

The assessment of an enterprise's capability to carry out the human-centred processes can be extended to identify the gaps between the existing and desired levels of performance of each HCD process. HCD methods and management actions can then be identified to fill the gaps and raise the level of performance in a way that is cost-effective for the particular organization. Repeated assessment can support a continuous improvement program for human-centred quality in the organization (see HCP.1.2 Activity 3).

In this application, the organization reviews the results of its process assessment against the outcomes and benefits achieved by better performance of each process. Where this would improve organizational performance in a cost-effective manner, the activities, outcomes and work products are used as a specification for change to its processes. This change is typically achieved in stages, and progress is measured by further assessments.

8.1.5 Development of competence in human-centred design

The processes can be used as a basis for a definition of professional competence for HCD professionals. An agreed model of the activities that constitute human-centred design can be used by professional bodies, academic institutions, training organizations and certification bodies.

In this application, competence is defined in terms of two dimensions, or axes. One axis is the set of HCD processes. The other axis defines the levels of proficiency in performing these processes. In an educational context, the structure can serve as a framework for skills and knowledge or, more specifically, as a basis for a course syllabus. The outcomes, activities and work products described for each process can be used to identify and link content for education and training courses in human-centred design and usability.

8.2 Applying the process descriptions

8.2.1 General

The approach used to describe processes in this document is based on the ISO/IEC 33000 family of standards and focuses on the outcomes, i.e. what is achieved when the process is carried out, not the detail of methods or the production of documents. This approach allows process descriptions to be applied to many different systems, projects and organizational settings. Process descriptions are brief and concise so that they can be interpreted for a wide range of management and development styles, methods and techniques.

8.2.2 Integration with systems and software engineering

The processes in this document can be integrated within an existing development life cycle to ensure the impact of key development decisions is not missed. They are not intended to present an alternative life cycle and can be harmonized with an existing development process that the organization follows.

The structure used for documenting HCD processes in this document is the same as that used for the International Standards for systems and software engineering processes. This allows HCD processes to be integrated with, and implemented and assessed in the same way as systems and software engineering standards, such as ISO/IEC/IEEE 15288, ISO/IEC/IEEE 12207, the ISO/IEC 33000 family of standards (SPICE) and CMMI. This common approach facilitates the integration of human-centred design with systems and software engineering.

NOTE 1 ISO/IEC/IEEE 15288:2015, 8.4.2.3.c) 2) refers readers to:

- ISO/TS 18152 for information on human-system issues; and
- ISO/IEC TR 25060:2010 for information on usability.

NOTE 2 ISO/IEC/IEEE 12207:2017, 6.4.2.3 notes that: “recommendations for identifying and treating human-system issues can be found in ISO/TS 18152”.

ISO/IEC/IEEE 12207:2017, 6.4.3.3 notes that “For systems that have usability requirements, recommendations for obtaining a desired level of usability can be found in ISO [...] 9241-220”.

ISO/IEC/IEEE 12207:2017, 6.4.5.3 notes that “ISO 9241-210 provides human centred design/ergonomic design guidelines”.

The activities and outcomes within the processes introduced in this document can be integrated within agile development such as “SCRUM”, “Disciplined Agile Delivery (DAD)” or “Lean UX”. In an agile development environment, the requirements for parts of the interactive system are typically derived and implemented within short timeframes and the implemented parts of the interactive system are evaluated immediately. Within agile development, each cycle can be considered a complete but short self-contained project. The range of activities in HCP.3 can each be relevant, but may be tailored (see [Annex B](#)) to the time frame available. Preliminary work to establish the overall context of use and known user requirements provides essential information for the success of implementing human-centred design in the agile development cycles detailing, refining and extending the preliminary work.

8.2.3 Implementation of the processes

The sets of process descriptions in this document are organized in a logical sequence. HCP.3 and HCP.4 do not constitute a life cycle as the processes can be repeated at different points in any life cycle. Processes are implemented taking account of the levels of usability, accessibility and/or user experience needed to minimize harm and maximize the opportunity for positive benefits (see [Annex F](#) for information about risk management and human-centred design).

Human-centred design can be implemented in a wide range of organizational contexts including those listed below. These are described in more detail in [D.2](#).

- Formality ranging from governance-centred to ad hoc.
- Both manufacturers and acquirers (including both off-the-shelf products and custom developments).
- Organizations ranging in size from small to large.
- Both introduction and improvement of human-centred design.
- Both top down and bottom-up application of human-centred design.
- Both system and service providers.

8.2.4 Iteration of processes

As an interactive system is defined, developed and maintained, processes are likely to be carried out, partly or fully, several times in a life cycle, and in various parts of an organization. HCD processes can be repeated, as the result of iterative development or continuous improvement of the system. Processes are performed whenever the need for specific outcomes arises. The duration and degree of rigour employed in the performance of a process depends on risk, context and requirements.

EXAMPLE 1 HCP.4 processes are used early in the lifecycle to define requirements related to introduction, operation and disposal.

EXAMPLE 2 Technical processes (HCP.3.2-5) are used recursively in the hierarchical decomposition of complex and large systems, and repeatedly for each agile iteration (e.g. within a sprint).

9 HCD process descriptions

9.1 Format

For each process or sub-process, this document specifies the following process elements:

- process title: a descriptive heading for a process;
- process purpose: describes the goal of performing the process;
- process benefits: describes how the process contributes to human-centred quality and/or human-centred design;
- process outcomes: the observable results obtained from the successful performance of the process. these are the criteria against which a process is assessed;
- process activities: activities that are typically performed to achieve the process outcomes. Each activity is followed by a list of associated outcomes (e.g. [a, b]). Activities provide evidence that processes have been performed;
- work products ([Annex A](#)): information items and other artefacts associated with the performance of a process. Work products provide evidence that processes have been performed. Examples of work products include business strategy, project plan, requirements specification, design documentation, and test plan. In order to simplify the presentation of processes in the main text, the work products associated with each process are described in [Annex A](#), which lists the work products for each process, and [Tables A.1](#) to [A.3](#) which describe the naming conventions used and the work products specific to human-centred design.

NOTE These elements are used by different people with different roles: the purpose and benefits are used strategically at a senior level, the outcomes are used to manage, and the activities are used technically at an implementation level.

The HCD processes in this document follow the format used in the ISO/IEC 33000 family of standards and the process description rules specified in ISO/IEC TR 24774.

9.2 Ensure enterprise focus on human-centred quality (HCP.1)

9.2.1 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/business success, corporate image or society, customer confidence, staff motivation, and human-system issues in governance and services.

NOTE 1 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 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.

NOTE 2 This process supports the ISO 27500 principle “Make usability and accessibility strategic business objectives”. [Clause C.1](#) explains how this document can support achieving the benefits of a human-centred organization described in ISO 27500.

These outcomes are achieved by performance of the following processes.

9.2.2 Incorporate human-centred quality in business strategy (HCP.1.1)

[Table 2](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.1.1.

Table 2 — Purpose, benefits, outcomes and activities of HCP.1.1

Process purpose	Explicitly take account of the human-centred quality of interactive systems in an organization's business strategy. NOTE This applies to both the human-centred quality of interactive systems acquired for use and those designed and developed by an organization.
Process benefits	The organization and affected stakeholders benefit from improved human-centred quality.
Process outcomes	a) Analysis 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. c) Strategic objectives for the human-centred quality of the organization's interactive systems in the market/work place 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.

Table 2 (continued)

Process activities (typical)	1) 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. [a, b]
	2) Decide how the organization will identify the objectives for the human-centred quality of its interactive systems. [c]
	3) Define strategic human-centred quality objectives for interactive systems. [c, d]
	4) Assess how human-centred quality is related to business benefits for the organization. [d, e]
	5) Explicitly plan for human-centred quality in financial management of programs and infrastructure. [c, d, e, f]
	6) Analyse social, educational and technological trends in staff and users. [c, f]

9.2.3 Institutionalize human-centred quality (HCP.1.2)

[Table 3](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.1.2.

Table 3 — Purpose, benefits, outcomes and activities of HCP.1.2

Process purpose	Establish and maintain a human-centred approach as normal practice in the organization.
Process benefits	The organization takes account of human-centred quality.
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.
Process activities (typical)	1) Designate a suitable member of the executive board to be responsible for championing a human-centred approach and getting top management endorsement. [a] 2) Establish and communicate a policy for achieving required levels of human-centred quality in the organization. [a] 3) Establish a continuous improvement program for human-centred quality in the organization. [a] 4) Establish and maintain awareness of the importance of human-centred quality. [b] 5) 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] 6) Ensure acceptance of human-centred activities in the organization. [d] 7) Develop the systems strategy to take account of user, other stakeholder and organizational requirements. [e]

9.3 Enable human-centred design across projects and systems (HCP.2)

9.3.1 Purpose and outcomes of HCP.2

The main audience for this set of processes is business unit/department, portfolio, program, 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 purpose of these processes is to provide the organization with an appropriate HCD capability, ensuring that human-centred design is resourced, conducted and consistent within the whole system life cycle process within and across systems over time, and that enterprise policies for human-centred design are implemented in every project as appropriate.

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; and
 - 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 following processes.

9.3.2 Integration of human-centred design (HCP.2.1)

[Table 4](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.2.1.

Table 4 — Purpose, benefits, outcomes and activities of HCP.2.1

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 benefits	Human-centred design is used appropriately.
Process outcomes	<ol style="list-style-type: none"> The organization has a shared understanding of human-centred design and how it is achieved. 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). Procedures are defined for integrating HCD activities with other system development activities. An effective mechanism is established for personal and technical communication related to human system issues. Strategic human-system issues and associated risks of harm related to systems and their use are identified and managed. The costs and benefits of particular HCD activities and the risks mitigated are known. Stakeholders relevant to the human-centred approach are involved. Human-centred quality objectives are included in the procurement process. Marketing and other relationships with external entities explicitly take account of human-centred quality as appropriate.
Process activities (typical)	<ol style="list-style-type: none"> Establish a common terminology for human-system issues within the organization. [a] Integrate human-centred design into the overall system development project plan. [b, c] Collect feedback on the management of human-system issues across the organization. [d] Develop effective procedures for communication between those responsible for human-centred design and other members of project teams. [c, d] Identify emerging human-system issues for the organization. [e, f] Identify and integrate stakeholders relevant to the human-centred approach. [g] Explicitly take account of human-centred quality in procurement. [h] Analyse image, client-relationships and competitive situation in the market place with respect to a human-centred approach. [i] NOTE The marketing function in an organization typically provides: <ul style="list-style-type: none"> Information on target user groups; insights in 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.

9.3.3 Resources for human-centred design (HCP.2.2)

[Table 5](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.2.2.

Table 5 — Purpose, benefits, outcomes and activities of HCP.2.2

Process purpose	To establish and maintain an effective infrastructure for human-centred design within the organization.
Process benefits	Human-centred design can be carried out as appropriate by each project.
Process outcomes	<ul style="list-style-type: none"> a) An agreed set of suitable HCD procedures, tools and methods representing accepted practise 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 to 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.
Process activities (typical)	<ul style="list-style-type: none"> 1) Define an authority to be responsible for maintaining and promoting the infrastructure for human-centred design (procedures, tools, methods, training and mentoring). [a, b] 2) Select, publish, review and maintain HCD procedures, tools and methods that are usable by the organization. [b] NOTE 1 This includes checking whether methods are used appropriately, i.e. produce valid results, and revising as necessary. 3) Define required competences in human-centred design and appropriate assessment methods. [d] 4) Establish training to reach and maintain required competences in Human-centred design. [d] 5) 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] 6) Mentor and monitor trained individuals to ensure that competence is effectively applied in the working environment. [d, f] 7) 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] NOTE 2 Principles, requirements and recommendations are published in various sources including the ISO 9241 series (see bibliography). These typically apply across user interface platforms, e.g. "colour should be used only as an additional means to code information".

9.3.4 Authorization and control of human-centred quality (HCP.2.3)

[Table 6](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.2.3.

Table 6 — Purpose, benefits, outcomes and activities of HCP.2.3

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 benefits	Appropriate levels of human-centred quality are achieved across the organization.
Process outcomes	<ol style="list-style-type: none"> Organization-wide objectives (HCP.3.1.1) for human-centred quality are defined. A governance process is established to manage projects' compliance with agreed standards. Human-centred quality is identified as criteria for approval of interactive systems and their elements. Performance against organizational objectives for human-centred quality is known. Deficiencies in human-centred quality are addressed. Acquisition includes requirements for human-centred quality. HCD practice and capability are contractual requirements on supplying organizations.
Process activities (typical)	<ol style="list-style-type: none"> 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] Establish a governance process to manage the project's compliance with agreed human-centred quality-related standards. [b] Include review and sign-off of human-centred quality in all reviews and decisions. [c] Monitor the achievement of objectives for human-centred quality. [c, d] Take corrective action when deficiencies in human-centred quality are identified. [e] Include requirements for human-centred quality in the criteria for acquisition. [f] Assess and improve HCD capability in organizations carrying out design and development of interactive systems. [g]

9.4 Execute human-centred design within a project (HCP.3)

9.4.1 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, and 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 assure human-centred quality for all types of project 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 (see [Annex C](#)).

These outcomes are achieved by performance of the following processes.

[Table 7](#) indicates the name of the equivalent activity in ISO 9241-210.

Table 7 — Names of HCD processes and equivalent ISO 9241-210 activities

	Name in this document	Name in ISO 9241-210	Reason for the difference in this document
HCP.3.1	Plan and manage human-centred design for the project	Planning human-centred design	Extension of scope
HCP.3.2	Context of use for each user group	Understand and specify the context of use	More representative of the content of this document
HCP.3.3	Establish the user requirements	Specify the user requirements	Wider scope
HCP.3.4	Design solution that meets user requirements	Produce design solutions	Clarification of scope
HCP.3.5	User-centred evaluation	Evaluate	Clarification of scope

9.4.2 Plan and manage human-centred design for the project (HCP.3.1)

9.4.2.1 Overall Purpose and outcomes

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 following processes.

9.4.2.2 Establish human-centred quality objectives (HCP.3.1.1)

[Table 8](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.3.1.1.

Table 8 — Purpose, benefits, outcomes and activities of HCP.3.1.1

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 benefits	<p>The project is guided by objectives for human-centred quality.</p> <p>NOTE 1 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).</p>
Process outcomes	<p>a) Human-centred quality objectives are derived from organizational objectives, business context, technological constraints and the intended context of use.</p> <p>b) Human-centred quality objectives are established and maintained for each applicable component of human-centred quality for each context of use:</p> <ul style="list-style-type: none"> — Avoidance of harm where appropriate (see E.5). 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. — 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. <p>c) Data collection (user research) is planned and resourced according to the needs of the project.</p> <p>d) Identified human-centred quality objectives are an integral part of the project success criteria.</p>
Process activities (typical)	<p>1) Review the relevant aspects of the context of use in order to identify relevant human-centred quality objectives. [a] NOTE 2 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. NOTE 3 Additional human-centred quality objectives can emerge with increased understanding of the context of use.</p> <p>2) Identify differences in human-centred quality objectives between the intended user populations (when there is more than one user population). [b]</p> <p>3) Analyse the overall project objectives with respect to the impact of human-centred quality. [a, b]</p> <p>4) Identify value-driven human-centred quality objectives for usability, accessibility, user experience and avoidance of harm from use. [b]</p> <p>5) Identify areas where more information is needed in order to further develop the detail of the human-centred quality objectives and of the context of use. [c]</p> <p>6) Communicate the human-centred quality objectives to relevant project stakeholders. [d]</p>

9.4.2.3 Manage threats and opportunities that arise from use of the interactive system (HCP.3.1.2)

[Table 9](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.3.1.2 throughout the project.

Table 9 — Purpose, benefits, outcomes and activities of HCP.3.1.2

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 benefits	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 Annex F for more details).
Process outcomes	<ol style="list-style-type: none"> The potential threats and opportunities related to human-centred quality are taken into account in the business case. The benefits of good human-centred quality are achieved for the project stakeholders for whom the success of the system is critical. Reasonably foreseeable harm from use is minimized or eliminated, in particular negative consequences for stakeholders for whom the success of the project/system is critical (for example to health, safety, finances or the environment). Potential opportunities related to use are considered. Potential conflicts between human-centred quality and other quality attributes are identified. Project resources for human-centred design 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.
Process activities (typical)	<ol style="list-style-type: none"> Incorporate issues related to human-centred quality in the development of the business case. [a] Identify project stakeholders for whom the success of the system is critical. [65] [b, c] Establish benefits that result from superior human-centred quality. [b, d] EXAMPLE 1 Medical application: to have patients spend less days needing dialysis. EXAMPLE 2 Consumer product: to have fewer customers initiating service calls. 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. Assess potential health and safety hazards including specific software (e.g. motion sickness in virtual reality) related risks and general environments risks (e.g. physiological). [c] Consider potential opportunities based on user needs and human-centred quality (e.g. for innovative solutions) [d] 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] 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] Determine project resources (including access to users) needed to mitigate risks to achievement of the required human-centred quality. [f]

9.4.2.4 Define extent of human-centred design in the project (HCP.3.1.3)

[Table 10](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.3.1.3.

Table 10 — Purpose, benefits, outcomes and activities of HCP.3.1.3

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 benefits	The resources necessary to achieve the required level of human-centred quality are defined and integrated in the overall project plan.
Process outcomes	<ol style="list-style-type: none"> 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. 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. The extent of user/stakeholder involvement, evaluation and iteration needed to give sufficient confidence that emerging requirements for human-centred quality are identified. 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. The required resources (people, budgets, users, time) for HCD are known.
Process activities (typical)	<ol style="list-style-type: none"> 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] Identify the HCD processes activities to be carried out to achieve the HCD Process outcomes. [a] Identify which human factors data are required by the project. [b] 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] Identify the degree of user/stakeholder involvement, evaluation and iteration required to achieve an acceptable degree of certainty of required human-centred quality. [c] 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] NOTE This can be carried out iteratively, for example in agile development. Identify resources (people, budgets, users, time) for HCD. [e]

9.4.2.5 Plan each HCD process activity (HCP.3.1.4)

[Table 11](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.3.1.4.

Table 11 — Purpose, benefits, outcomes and activities of HCP.3.1.4

Process purpose	To ensure that the work products produced by each HCD activity achieve the quality required for use by the project.
Process benefits	The HCD activities needed to achieve the required levels of human-centred quality are planned.
Process outcomes	<ul style="list-style-type: none"> 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.
Process activities (typical)	<ul style="list-style-type: none"> 1) 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] 2) Select method(s) for conducting each HCD activity. [b] 3) Customize HCD procedures and customize associated tools and methods as appropriate to provide sufficient and timely information to the project. [b, d] 4) Obtain necessary authorizations and approvals (e.g. ethical approval). [c] 5) Define work products to be produced by each HCD process activity (see Annex A). [d] 6) Define suitable formats for the work products that result from the HCD process activities. [d] 7) Identify at which point of time each work product is needed in the project. [e] 8) Plan each HCD process activity in terms of resources (people with appropriate skills, budgets, time). [a, e] 9) 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] 10) 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] 11) Assign competent staff (internal or external) to conduct each HCD activity. [a, h, i]

9.4.2.6 Manage HCD process activities within the project (HCP.3.1.5)

[Table 12](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.3.1.5 throughout the project.

Table 12 — Purpose, benefits, outcomes and activities of HCP.3.1.5

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 benefits	The HCD process activities needed to achieve the required levels of human-centred quality is carried out.
Process outcomes	<ol style="list-style-type: none"> Each HCD process activity is conducted as defined to deliver the specified work product. Required work products of HCD process activities are available when needed as input to the project. System work products (e.g. system architecture) are improved where necessary based on the results of HCD activities. The project plan and HCD activities are adjusted where necessary based on emergent data delivered by HCD activities. Work is conducted according to the organizational objectives for human-centred design and human-centred quality (see HCP.2)
Process activities (typical)	<ol style="list-style-type: none"> Deliver agreed work products for each HCD process activity. [a] Monitor the accomplishment for each HCD activity. [a, b] Communicate work products of each completed HCD activity to stakeholders in project. [b] 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] Review the HCD activities within the project plan throughout the life of the project. [c, e] Ensure that HCD work products are appropriately acted on. [d].

9.4.3 Identify the context of use (HCP.3.2)

9.4.3.1 Overall purpose and outcomes

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 contexts of introducing or selling and the context of managing the system in operation.

These outcomes are achieved by performance of the following processes.

9.4.3.2 Identify the intended user population and differentiate groups of users (HCP.3.2.1)

Table 13 describes the purpose, benefits, outcomes and process activities to be conducted within HCP.3.2.1.

Table 13 — Purpose, benefits, outcomes and activities of HCP.3.2.1

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 benefits	The intended user population is known and provides a basis for describing the context of use.
Process outcomes	<ul style="list-style-type: none"> 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.
Process activities (typical)	<ul style="list-style-type: none"> 1) Identify users based on the intended target audience for the interactive system. [a] 2) 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] 3) 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] 4) 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] 5) Include potential users with accessibility needs to the greatest extent possible, including all potential users covered by any legislation. [b] 6) Identify any types of users who are not included in the intended context of use, and the reasons why they are not included. [d]

9.4.3.3 Identify other relevant aspects of the context of use and reported issues (HCP.3.2.2)

[Table 14](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.3.2.2.

Table 14 — Purpose, benefits, outcomes and activities of HCP.3.2.2

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 benefits	The context of use is described.
Process outcomes	<ul style="list-style-type: none"> 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/evaluation.
Process activities (typical)	<ul style="list-style-type: none"> 1) Agree on the scope for context of use analysis (e.g. tasks and environments to be focussed 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] 2) Select and use appropriate method(s) for collecting and describing context of use information (such as context interviews, observations, user self-reports, etc.). [a] 3) 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] 4) Carry out task analysis in order to understand identified tasks and the relationships between them. [a] 5) Assess risks associated with using the interactive system, for example if tasks are performed incorrectly. [b] 6) Describe the context of use for each intended/actual user group in a suitable format and sufficient detail for later use (e.g. user needs analysis, user requirements specification and evaluation). [a] 7) Create and evaluate design concepts to obtain a better understanding of the context of use. [c] 8) Decide whether the quality of information is complete and in sufficient detail or whether further investigation is required. [c] 9) Communicate information about the context of use to relevant project stakeholders. [a, b, c]

9.4.4 Establish the user requirements (HCP.3.3)

9.4.4.1 Overall purpose and outcomes

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 following processes.

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.

9.4.4.2 Identify the user needs (HCP.3.3.1)

[Table 15](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.3.3.1.

Table 15 — Purpose, benefits, outcomes and activities of HCP.3.3.1

Process purpose	To provide the basis for deriving a comprehensive set of valid user requirements.
Process benefits	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.
Process activities (typical)	1) 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]

Table 15 (continued)

	<p>EXAMPLES of user needs</p> <ul style="list-style-type: none"> i) Renting a car: A car driver with an injured foot needs to have a rental car with automatic gear, 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 healthcare 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. <ul style="list-style-type: none"> 2) 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] 3) 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] 4) Identify opportunities for new solutions to user needs. [b] 5) Identify existing problems, deficiencies and workarounds related to systems in use. [c] 6) 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] 7) 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]
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9.4.4.3 Specify the user requirements (HCP.3.3.2)

[Table 16](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.3.3.2.

Table 16 — Purpose, benefits, outcomes and activities of HCP.3.3.2

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 benefits	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	<ol style="list-style-type: none"> 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: <ol style="list-style-type: none"> 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.
Process activities (typical)	<ol style="list-style-type: none"> 1) 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] 2) Analyse the human-centred quality objectives, user needs and relevant ergonomic guidance to establish the user requirements. [b] 3) Use-related quality requirements can be specified as required to meet criteria for human-centred quality. [b] EXAMPLES of use-related quality requirements <ol style="list-style-type: none"> i) 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. ii) 80 % of all potential users of the ticket machine shall prefer the use of the ticket machine to the use of the ticket counter.

Table 16 (continued)

	<p>iii) With the ticket machine, 95 % of users shall be able to buy the cheapest ticket to a location within 30 s.</p> <p>iv) The percentage of use errors made by users that can cause harm (under specified conditions) shall not be greater than 1 %.</p> <p>v) The mean rating given by user group X for the company's reputation as the market leader for quality and innovation does not decrease after the users read advertising material for the new product.</p> <p>NOTE 1 Quality requirements can be used to guide design and development, even if they are not subsequently used as acceptance criteria.</p> <p>4) User-system interaction requirements are specified based on human-centred quality objectives, user needs and ergonomic guidance. [b, e]</p> <p>NOTE 2 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.</p> <p>EXAMPLES of user-system interaction requirements</p> <p>i) Communicating with the bank: "With the system the user shall be able to select the preferred means of communication with the bank in terms of telephone, self-service portal or personal visit."</p> <p>ii) Renting a car (using a car rental website): "With the system the user shall be able to enter the desired date and time of rental."</p> <p>iii) Monitoring the health state of patients at an intensive care unit (using a mobile medical app): "With the system the user shall be able to immediately detect whether the heart rate of the patient is decreasing."</p> <p>iv) Accessing health records: "With the system the user shall only be able to see health records for which authorization has been granted."</p> <p>5) Incorporate relevant guidance from ergonomics, including user interface and interaction design guidance, standards and guidelines (including ISO 9241-110). [b]</p> <p>NOTE 3 This can be achieved by using a style guide that is based on existing standards and other good practice.</p> <p>6) Identify whether different user groups have different requirements. [a]</p> <p>7) Structure the user requirements in a form that can be used by the project team. [c]</p> <p>EXAMPLE 1 User-system interaction requirements are structured by each corresponding task to be supported by the system.</p> <p>8) Identify and resolve potential conflicts among the user requirements. [c]</p> <p>9) Prioritize each user requirement (from the perspective of the users) with representatives of the user groups. [c, d]</p> <p>10) Evaluate the user requirements or design concepts (for example using low fidelity prototypes) in order to refine the user requirements (HCP.3.5.1). [d]</p> <p>11) 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]</p> <p>12) Identify emergent organizational requirements that need to be implemented to enable the implementation of user requirements. [f]</p> <p>EXAMPLE 2 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."</p>
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Table 16 (continued)

	13) 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]
	14) Communicate the user requirements specification to all relevant project stakeholders. [h]

9.4.4.4 Negotiate and prioritize the user requirements in the context of a project (HCP.3.3.3)

Table 17 describes the purpose, benefits, outcomes and process activities to be conducted within HCP.3.3.3.

Table 17 — Purpose, benefits, outcomes and activities of HCP.3.3.3

Process purpose	To ensure that potential conflicts between user requirements, stakeholder requirements and other project requirements are resolved.
Process benefits	User requirements are taken into account in the specification of the interactive system.
Process outcomes	<ol style="list-style-type: none"> Relationships between user requirements and other requirements are known. Integration requirements with other systems are accepted in order to deliver unified user experience. Implementation priorities are assigned to all user requirements. The feasibility of meeting the high priority user requirements forms part of feasibility studies for technical solutions. An accepted and consistent set of user requirements can be used in the definition of system requirements. System capabilities are delivered in an appropriate sequence across multiple releases to achieve optimal human-centred quality for each release.
Process activities (typical)	<ol style="list-style-type: none"> Identify dependencies and relationships between user requirements and other requirements, including other stakeholder and project requirements (such as buy-or-build). [a] Identify the interdependencies and integration requirements of the system with other systems in terms of user interface, business process/work flow, data, architecture, capabilities, etc. [b] 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] Identify the risks to human-centred quality associated with not implementing each user requirement. [c] Assign an implementation priority to each user requirement. [c] Identify the feasibility of, and costs associated with, implementing high-priority user requirements. [d] Agree on the implementation of user requirements (involving user groups and project stakeholders). [e] Document the rationales for rejected user requirements so that these can be understood in the future. [e] Deliver system capabilities in an appropriate sequence across multiple releases. [f]

9.4.5 Design solutions that meet user requirements (HCP.3.4)

9.4.5.1 Overall purpose and outcomes

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 start 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 solution is available that takes 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;
- a basis for assessing the costs for implementation of a solution that meets user requirements is provided.

These outcomes are achieved by performance of the following processes.

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

9.4.5.2 Specify the user-system interaction (HCP.3.4.1)

[Table 18](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.3.4.1.

Table 18 — Purpose, benefits, outcomes and activities of HCP.3.4.1

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 benefits	The user-system interaction is designed to address the high-level human-centred quality objectives.
Process outcomes	<ul style="list-style-type: none"> 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.
Process activities (typical)	<ul style="list-style-type: none"> 1) 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 (visual, auditory, tactile, etc.) to determine the best interactions to be implemented in design. [a] 2) 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] 3) Create a task model by decomposing each task into sub-tasks as a set of activities meaningful to the intended user. [c] 4) Describe for each task the precondition(s) and the intended outcome to be achieved. [c] 5) Define the rules for allocating actions between user and system as a meaningful set of tasks that will optimize human-centred quality. [d] 6) 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] 7) Identify and apply user interface design guidance for the aesthetic aspects of the design (including physical, tactile, visual, auditory aspects). [g] 8) Decide whether the interaction specification is adequate for producing the design solution or whether further investigation is required. [f, h]

9.4.5.3 Produce and refine user interface design solutions (HCP.3.4.2)

[Table 19](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.3.4.2.

Table 19 — Purpose, benefits, outcomes and activities of HCP.3.4.2

Process purpose	<p>To produce and iteratively evaluate user interface design solutions from a user perspective to ensure that user requirements have been met.</p> <p>NOTE 1 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.</p>
Process benefits	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	<ol style="list-style-type: none"> The potential benefits of innovative solutions for the user interface design have been considered. User interface technology is selected that supports the identified user-system interaction. A user interface design solution is available that enables completion of one or more tasks by the intended range of users. The user's interaction with the user interface design solution has been evaluated for acceptable human-centred quality before technical implementation. 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. Necessary corrective actions are initiated if the user interface design solution does not sufficiently meet the user requirements. 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).
Process activities (typical)	<ol style="list-style-type: none"> Explore the potential benefits of using an innovative solution (the use of creative design and/or new technologies). [a] Select the appropriate user interface technology for the system to support the identified user-system interaction, in conjunction with other project stakeholders. [b] Create an interface design solution that implements one or more user's requirements that support tasks defined in the context of use description. [c] If providing accessibility, decide whether to use a single design for all approaches or whether to support individualization to specific user needs. [c] Identify appropriate interaction styles (dialogue techniques). [c] Derive the necessary interaction objects, the sequence and timing (dynamics) of the interaction and the navigation structure. [c] Design the information architecture to allow efficient access to interaction objects. [c]

Table 19 (continued)

	<p>8) 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]</p> <p>9) 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]</p> <p>NOTE 2 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.</p> <p>10) Evaluate design with users in order to identify previously unidentified context information, identify emergent needs, and refine the user requirements, to identify design improvements and to ensure that any required objectives for human-centred quality have been achieved. (HCP 3.5) [d]</p> <p>11) Iteratively adapt the concept based on the findings of user-centred evaluation until an acceptable cost-effective solution is obtained. [e, f]</p> <p>i) Take account of the costs and benefits of proposed changes when deciding what will be modified.</p> <p>ii) Decide (using HCP.3.5) if the user interface design solution sufficiently meets the user requirements.</p> <p>12) Communicate the acceptable solution to the development team, based on the user requirements and tasks to be supported by the solution. [g]</p> <p>NOTE 3 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 then requirements established in HCP.3.4.1.</p>
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9.4.6 User-centred evaluation (HCP.3.5)

9.4.6.1 Overall purpose and outcomes

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 HCP.3.2, HCP.3.3, HCP.3.4, HCP.4.1 and HCP.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 conformance 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 following processes.

9.4.6.2 Plan for evaluation throughout the project (HCD 3.5.1)

[Table 20](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.3.5.1.

Table 20 — Purpose, benefits, outcomes and activities of HCP.3.5.1

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.
Benefits	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	<p>a) Evaluation to achieve the following purposes is planned as part of the referenced processes.</p> <ul style="list-style-type: none"> 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). <p>b) The aspects of human-centred quality to be evaluated are decided.</p> <p>c) Appropriate methods and degree of user involvement to be employed for evaluation are agreed on (ISO/IEC 25066 describes different types of evaluation).</p> <p>d) The work products to be delivered for each evaluation activity are specified.</p> <p>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.</p> <p>f) Iterative evaluation is carried out if necessary.</p>

Table 20 (continued)

Process activities (typical)	<ol style="list-style-type: none"> 1) 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]. 2) Identify which aspects of human-centred quality are to be evaluated, that can include: [b]. <ol style="list-style-type: none"> 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. 3) Decide which methods to use, and degree of user involvement for each type of evaluation and object of evaluation. [c, d] (See ISO/IEC 25066 for more details.) 4) 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]. 5) 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] 6) Plan degree of iteration in terms of number of evaluation cycles to be expected taking account of project risks. [g] 7) 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]
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9.4.6.3 Plan each evaluation (what to evaluate and how) (HCP.3.5.2)

[Table 21](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.3.5.2.

Table 21 — Purpose, benefits, outcomes and activities of HCP.3.5.2

Process purpose	To identify the most appropriate evaluation method(s) to use and plan how the results will be used.
Benefits	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	<ul style="list-style-type: none"> 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. <ul style="list-style-type: none"> 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.
Process activities (typical)	<ul style="list-style-type: none"> 1) Identify the intended outcomes of the specific evaluation, which can include: [a] <ul style="list-style-type: none"> 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. 2) Agree on the user group(s) to be considered for the evaluation (HCP.3.2.1). [c] <p>NOTE 1 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.</p> 3) Select the context of use to be used for evaluation that adequately represents the real context of use. [c] <p>NOTE 2 If tasks are used, then tasks are specified based on the users' intended objectives.</p> 4) Agree appropriate methods for the inspection-based or user-based evaluation and the evaluation schedule. [b] <p>NOTE 3 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.</p> 5) 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] 6) Plan the involvement of stakeholders as appropriate. [d] 7) Plan the communication of evaluation outcomes. [d]

9.4.6.4 Carry out each evaluation (HCP.3.5.3)

[Table 22](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.3.5.3.

Table 22 — Purpose, benefits, outcomes and activities of HCP.3.5.3

Process purpose	To obtain the information needed to achieve the evaluation objectives identified in HCP.3.5.2.
Process benefits	Potential or actual problems related to human-centred quality are identified.
Process outcomes	<ol style="list-style-type: none"> 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.
Process activities (typical)	<ol style="list-style-type: none"> 1) Conduct evaluation according to agreed-upon methods. [a] 2) Carry out sufficiently comprehensive evaluation to provide meaningful results for the system as a whole. [a] 3) Analyse the evaluation results, which can include the following: [a] <ol style="list-style-type: none"> 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 base line 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. 4) Prioritize any issues from a user perspective and propose solutions. [b] 5) 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] 6) Communicate the evaluation results to all relevant stakeholders involved in the process. [c]

9.5 Introduction, operation and end of life of a system (HCP.4)

9.5.1 Overall purposes and outcomes

The main audience for this set of processes is operations managers, service and support managers, and 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/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 [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.

These outcomes are achieved by performance of the following processes.

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

9.5.2 Introducing the system (HCP.4.1)

[Table 23](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.4.1.

Table 23 — Purpose, benefits, outcomes and activities of HCP.4.1

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 benefits	The factors that affect human-centred quality during introduction of a system are known, documented and addressed.
Process outcomes	<ul style="list-style-type: none"> 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.
Process activities (typical)	<ul style="list-style-type: none"> 1) Determine and communicate impact of introduction on users and stakeholders. [a] 2) Identify user requirements for any enabling systems or services required for implementation. [b] 3) 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] 4) 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] 5) Identify needs for customization/localization, training and documentation. [a, c] 6) Define communication to stakeholders, and actual/potential users. [a, f] 7) Develop and deliver help, instructions and training material. [g] 8) Develop and implement a user support system. [h] 9) Manage the changes required to introduce the system. [i] 10) Identify and monitor human-system issues when the system is first used. [k] 11) Identify differences between expected and actual context of use. [j, l] 12) Perform user-centred evaluation after introduction. [l] 13) Implement improvements to the interactive system. [j, l]

9.5.3 Human-centred quality in operation (HCP.4.2)

Table 24 describes the purpose, benefits, outcomes and process activities to be conducted within HCP.4.2.

Table 24 — Purpose, benefits, outcomes and activities of HCP.4.2

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 benefits	The factors necessary to maintain human-centred quality with an operational system are known, reported and addressed.
Process outcomes	<ul style="list-style-type: none"> 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.
Process activities (typical)	<ul style="list-style-type: none"> 1) Systematically monitor the context of use of the operational system for changes. [a] 2) Investigate system use to collect and analyse user and stakeholder feedback for human-system and human-centred quality issues. [b] 3) Identify use-related human-system issues of the system including the extent to which user and maintainer support needs are being met. [b] 4) Systematically monitor adverse events to identify emergent health, safety, and environmental issues. [b, c] 5) Assess compliance with applicable health, safety, and environmental operational regulations. [c] 6) Resolve and document identified health, safety and environmental issues, and verify that solutions do not create additional issues. [c] 7) Identify user requirements for corrective and preventive maintenance strategies, enabling systems or services, as well as resources, needed for maintenance. [d] 8) Identify and address human-systems issues in maintenance and redesign, and ensure that resolutions do not negatively impact human-centred quality. [e] 9) Assess the potential impact of new technologies on usability/ maintainability/ increased human-centred quality. [a] 10) Assess the impact of changes on users including usability, accessibility, user experience and potential harm or benefits that can arise from use. [a] 11) Assess the impact of changes on training, help, user support and synchronisation across user platforms. [a] 12) Prioritize human-system issues. [g] 13) Develop a human-centred upgrade list. [g]

9.5.4 Human-centred quality during upgrades (HCP.4.3)

[Table 25](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.4.3.

Table 25 — Purpose, benefits, outcomes and activities of HCP.4.3

Process purpose	Modification of the existing system takes account of the evolution of the context of use and changing user requirements
Process benefits	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	<ul style="list-style-type: none"> 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.
Process activities (typical)	<ul style="list-style-type: none"> 1) Assess the potential impact of new technologies on usability/maintainability/increased human-centred quality. [a] 2) Identify use-related human-system issues of the existing system. [a] 3) Investigate actual system usage. [b] 4) Analyse user and stakeholder feedback for human-system and human-centred quality issues [b] 5) Analyse health, safety, quality and environment issues. [b] 6) Identify in what ways the requirements for the future system need to take account of how the existing system is used. [b] 7) Develop a human-centred upgrade list. [c] 8) Prioritize human-system issues. [c] 9) Identify the existing user requirements that are to be retained for the future system. [c] 10) Provide feedback to supply organizations about human-centred quality issues identified in operations so that future systems can be improved. [d] 11) Assess the impact of changes on human-centred quality. [f] 12) Assess the potential impact of upgrades on training, help, user support and synchronisation across user platforms [f] 13) Modify the system to address human-system issues identified by evaluation in use. [f]

9.5.5 Human-centred quality at the end of life of a system (HCP.4.4)

[Table 26](#) describes the purpose, benefits, outcomes and process activities to be conducted within HCP.4.4.

Table 26 — Purpose, benefits, outcomes and activities of HCP.4.4

Process purpose	To take into account the needs of users and stakeholders during the retirement or replacement of a system.
Process benefits	The factors related to human-centred quality at the end of life of a system are known, reported and addressed.
Process outcomes	<ul style="list-style-type: none"> 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 re-allocation, 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.
Process activities (typical)	<ul style="list-style-type: none"> 1) Investigate actual system usage. [a] 2) Identify in what ways the requirements for the future system need to take account of how the existing system is used. [b, h] 3) 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] 4) Identify whether there are any consequences for users related to loss of the system. [b, e, f, g, h] 5) Develop a plan for system retirement, disposal, and/or replacement. [g] 6) Conduct debriefing and retrospective analysis for a replacement system. [c, e] 7) Identify use-related human-system issues of the existing system. [c, g, h] 8) Collect and analyse in-service reports to generate updates or lessons learnt for the next version of the system. [c, g, h] 9) Define how users will be re-allocated, dismissed, transferred to other duties [d] 10) Communicate system end of life and potential alternatives to users. [d] 11) Plan break-up of social structures [d] 12) Identify risks including health and safety issues associated with removal from service and destruction of the system. [f] 13) Comply with all health, safety, regulatory and environmental regulations applicable to system destruction and/or disposal. [f]

Annex A (informative)

Work products for HCD processes

A.1 Work products and their use

A.1.1 General

Work products are produced by the execution of processes. They are evidence of the achievement of process outcomes and of the performance of the relevant activities. They can be used as follows:

- as part of process assessment, where the existence, content and quality of work products is an indicator of an organization or project's capability to perform processes;
- as part of process implementation, where a standard work product description (such as those in [Annex A](#)) can be used to define the content and quality of organization- or project-specific documents, or other artefacts;
- the list of work products associated with a process can be used in the design of an organizational life cycle model or adaptation of this life cycle for a particular project.

NOTE 1 Examples of work products in [A.3](#) include the quality management goals and objectives, a user needs report, a risk management report and the training strategy.

NOTE 2 Not all outcomes are work products. For example, it is possible that outcomes that describe a change in an organization have no associated work products.

A.1.2 Use of work products

Work product characteristics can be used when reviewing potential inputs and outputs of process implementation. The characteristics are provided as guidance for the attributes to look for (in a particular sample work product) to provide objective evidence supporting the assessment of a particular process.

Work products and their characteristics are a starting point for considering whether (given the project context) they make a contribution to the intended purpose of the process. Assessment of a process should also take account of the process context (application domain, business purpose, development methodology, size of the organization, etc.).

The information items in work products may be combined in organizational or project-specific documents. This annex does not specify how the contents of such documents are packaged. In order to give flexibility, the medium used to describe the work products is not defined. For example, in large, critical systems projects, there is a reliance on documentation while in software projects using agile development methods, there is more reliance on personal communication. [Clause B.3](#) gives recommendations for planning information management and documentation.

A.1.3 Sources of the work products in this document

To ensure integration of human-centred design processes with the system life cycle, this document maps the outcome of human-centred design to system life cycle work products in the ISO/IEC standards for systems and software engineering as detailed in ISO/IEC 15504-6:2013, Annex B.

In some cases, work products are unique to human-centred design. These work products are outlined in ISO/IEC TR 25060 and are documented in detail in the ISO/IEC 2506x family of standards.

Users of this document should refer to these standards for more information about the work products and their characteristics.

[Clause 3](#) includes a mapping between the work products and the appropriate HCD process or processes.

A.2 Description of work products

A.2.1 Generic work products

[Table A.1](#) describes the components of the work product description used in this document.

Table A.1 — Work product identification

Work product identifier #	A two-part identifier number for the work product that is used to reference the work product. For work products in the ISO/IEC 15504 series the first part of the identifier indicates the generic work product type. This is a useful way of identifying the type of work product if it does not use the naming convention, e.g. policies and strategies fall within the type “plan”.
Work product name	Provides an example of a typical name associated with the work product characteristics. This name is provided as an identifier of the type of work product the practice or process produces. Organizations may call these work products by different names. The name of the work product used in the organization is not significant. Similarly, organizations can have several equivalent work products, which contain the characteristics defined in one work product type. The formats for the work products can vary. It is up to the assessor and the organizational unit coordinator to map the actual work products produced in their organization to the examples given here.
Work product characteristics	Provides examples of the potential characteristics associated with the work product types. The assessor may look for these in the samples provided by the organizational unit.

[Table A.2](#) describes the generic types of work products.

Table A.2 — Types of work product

WP ID	Generic work product name	Generic work product characteristics
1.00	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.
2.00	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.
3.00	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.
4.00	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 method in order to achieve technical or managerial goals or outcomes.

WP ID	Generic work product name	Generic work product characteristics
5.00	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 to confirm achievement of performance, fiscal or legal conditions or obligations.
6.00	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 impart situation, affects, progress or achievement. It serves to inform so that decisions or subsequent actions can be taken.
7.00	Request	A communication that initiates a defined course of action or change in order to fulfil a need. This can originate or control on-going 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.
8.00	Specification	Criteria or conditions that place limits or restrictions on actions, attributes or qualities. It establishes measures or qualities for determining acceptability, conformance or merit. It can be required as part of an agreement or contract.

A.2.2 Specific work products related to human-centred quality described in ISO/IEC TR 25060

[Table A.3](#) describes the work products specified in the ISO/IEC TR 25060 common industry formats for usability.

Table A.3 — HCD work products from ISO/IEC TR 25060

WP ID	Work product name	Work product typical characteristics
CIF3	Context of use description	<ul style="list-style-type: none"> — The overall goals of the system. — The stakeholder groups who either use the interactive system or are affected by its output throughout the life cycle of the interactive system. — The characteristics of the users. — The task goals and task characteristics. — Information processed during tasks. — Resources. — Technical environment (hardware, software and materials). — Physical and social environments.
CIF4	User needs report	<ul style="list-style-type: none"> — Identified, stated, derived and implied user needs across all identified user groups (cognitive, physiological, social). — The user needs derived from or modified on the basis of other stakeholders that have been identified to be relevant within the context of use description. — The results of the user needs analysis relating the described context of use and its development constraints to the tasks of each user group who are affected including any resulting human-system issues or risks

Table A.3 (continued)

WP ID	Work product name	Work product typical characteristics
CIF5	User requirements specification	<ul style="list-style-type: none"> — Reference to the context of use description intended for the design. — Requirements derived from the user needs and the context of use; for example, there is a requirement for a product to be used outdoors. — Requirements arising from relevant ergonomics and user interface knowledge standards and guidelines. — Usability requirements and objectives including measurable effectiveness efficiency and satisfaction. — Criteria in specific contexts of use. — Requirements derived from organizational requirements that directly affect the user.
CIF6	Evaluation report	<ul style="list-style-type: none"> — Improving the usability of the object of evaluation. — Defining a baseline (the data used as a reference with which to compare future evaluation results) for usability for the whole system, product or service. — Comparing systems, products or services (e.g. to inform decisions about purchasing off-the-shelf components or systems). — Comparing a system, product or service with (one or more sets of) predefined requirements (e.g. the requirements of two different user groups). — Enabling decisions on redesign or replacement of an existing system, product or service. — Identifying failures in the development process. — Reporting usability problems, derived user requirements and recommendations for improving the usability of the object of evaluation. — Reporting a baseline for usability for the whole system, product or service. — Reporting differences in usability across a set of systems, products or services (two or more systems, products or services). — Reporting conformity with user requirements (conformance test report). — System, product or service identification. — Evaluation objectives. — Predefined user requirements. — Methods used. — Participant descriptions. — Findings (positive and defects).

Table A.3 (continued)

WP ID	Work product name	Work product typical characteristics
		<ul style="list-style-type: none"> — Unsatisfied user requirements. — Emergent user requirements and recommendations. — Data obtained from the evaluated interactive system. — Data analysis (e.g. cause and effect).
CIF7	User interaction specification	<ul style="list-style-type: none"> — Workflow design: the overall interrelationship (including sequences) between tasks and system components on an organizational level, including responsibilities and roles. — Task design: all tasks broken down into sets of sub tasks and allocation of sub tasks to the user and the system and associated requirements. — Dialogue model: for each task, the appropriate information exchange between user and system including sequence and timing as well as associated interaction objects and high-level selection of dialogue techniques. — Task specific detailed usability objectives. — Information architecture: from the user's perspective.
CIF8	User interface specification	<ul style="list-style-type: none"> — The task objects and system objects needed to accomplish one or more tasks, and the user interface elements that they are composed of <ul style="list-style-type: none"> — their properties, behaviours and relationships; — the dialogue techniques employed for specific tasks (e.g. menus, form based dialogues, command dialogues, combinations of those); — views of task objects and system objects for specific tasks, users and user groups.
CIF9	Field data report	<ul style="list-style-type: none"> — Data on actual usage of the system, product or service (versus intended usage of the system, product or service). — Sources of field data including observation of use, user satisfaction surveys, usage statistics and help desk data. — Field data and its sources including: <ul style="list-style-type: none"> — the actual context of use; — the means of collecting the data; — the reasons for its collection; — any identified user needs; — derived user requirements.

A.3 Process work product list

A.3.1 Format of the list

[Table A.4](#) lists the work products associated with each of the processes described in this document. Two categories of work products are listed for each process.

- Those that are used as input for the process (“input work products”). This information is useful to know when carrying out the process.

Table A.3 (continued)

- Those that are being produced by the process (“output work products”). This is information that is produced or changed as a result of carrying out the process.

The last column of the table contains notes regarding particular human-centred issues for the work products related to the system life cycle.

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

Each work product is prefixed by a reference number that indicates the work product and the standard in which it is defined. Work products from ISO/IEC TR 25060 are preceded by “CIF”. Those from ISO/IEC 15504-6 are prefaced by a two-part work product ID from that standard. The naming and numbering convention for work products is described in [A.2](#).

Output work products are suffixed with the item number of the process outcome that creates or updates the work product.

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

A.3.2 Use of the list

To obtain a full understanding of a work product and its purpose in relation to a process see:

- 1) the process description in [Clause 9](#) [for example [9.4.3.3](#), [Table 14](#) “Identify the user needs (HCP.3.3.1)”];
- 2) the relevant row in [Table A.4](#) [for example the row beginning “Identify the user needs (HCP.3.3.1)”];
- 3) the outcome(s) listed in the process description, the closest relation is indicated by the suffixed referenced letter; [for example, Outcome a) “The user needs are comprehensively described and documented” and “CIF.4 User needs report (a)”];
- 4) the detail of the information within the standard that describes the work product. CIFs are summarized in A.2.4. The specific system life cycle work products produced as a result of a particular human-centred design process are identified by a two-part numerical identifier. These are described in ISO/IEC 15504-6:2013, Annex B.

A.3.3 Process work product list

[Table A.4](#) lists the work products for each HCP process described in [Clause 9](#).

Table A.4 — Work products for each process described in this document

Process	Input work products	Output work products	Notes
Ensure enterprise focus on human-centred quality (HCP.1)			
Incorporate human-centred quality in business strategy (HCP.1.1)	3.02 supply strategy 3.03 business strategy 6.10 customer satisfaction report 8.08 quality management goals and objectives	3.02 supply strategy (c) 3.03 business strategy (b) 6.06 investment decision report (e) 8.08 quality management goals and objectives (d)	
Institutionalize human-centred quality (HCP.1.2)	3.02 supply strategy 3.03 business strategy 3.04 system life cycle management policy 6.04 system life cycle model review	3.01 acquisition strategy (b) 3.02 supply strategy (b) 3.08 quality management policy (c) 3.04 system life cycle management policy (d) 6.07 system life cycle process review (e)	
Enable human-centred design across projects and systems (HCP.2)			
Integration of human-centred design (HCP.2.1)	3.04 system life cycle management policy 3.06 system life cycle process policy 3.08 quality management policy 6.07 system life cycle process review	2.01 system life cycle stage model (a) 3.04 system life cycle management policy (b) 3.06 system life cycle process policy (c) 3.11 technical management plan (d, f) 3.08 quality management policy (h) 6.08 system life cycle improvement report (e, f)	
Resources for human-centred design (HCP.2.2)	3.04 system life cycle management policy 3.06 system life cycle process policy 3.07 training strategy 3.08 quality management policy	1.03 competent personnel (d) 2.04 system life cycle process model (a, b) 3.06 system life cycle process policy (a) 3.07 training strategy (d) 3.11 technical management plan (c, e, f)	3.1.1 technical management plan includes HCD procedures and HCD design guidelines, standards and other human factors data related to human-centred quality.

Process	Input work products	Output work products	Notes
Authorization and control of human-centred quality (HCP.2.3)	3.01 acquisition strategy 4.01 supplier selection procedure 4.03 quality management system 6.01 supplier assessment report 6.02 delivery acceptance report 6.11 quality management report	3.01 acquisition strategy (c, f) 3.02 supply strategy (c) 4.01 supplier selection procedure (c, f) 4.03 quality management system (b, c, e) 6.03 supply performance report (d) 7.02 acquisition agreement change request (e) 7.03 supply proposal (c, g) 7.06 supplier directive (c, e) 8.02 delivery acceptance criteria (c, f, g) 8.03 supply agreement (b, g) 8.09 quality measures (a)	An organization is an acquirer and a supplier. Quality criteria are for internal projects as well as external acquisition.
Execute human-centred design within a project (HCP.3)			
Plan and manage human-centred design for the project (HCP.3.1)			
Establish human-centred high-level quality objectives (HCP.3.1.1)	CIF.3 Context of use 8.03 supply agreement 8.12 stakeholder requirements	CIF.5 user requirements (b) 8.04 project requirements (c, d)	CIF.5 includes human-centred quality objectives.
Manage threats and opportunities that arise from use of the interactive system (HCP.3.1.2)	CIF.3 context of use CIF.5 user requirements 8.04 project requirements 8.12 Stakeholder requirements	3.14 decision-making strategy (a, d, e) 3.15 risk management strategy (c, d) 5.04 risk register (c, e) 6.18 risk management report (f) 8.04 project requirements (f)	
Define extent of HCD in the project (HCP.3.1.3)	CIF.5 user requirements 6.18 risk management report (f) 8.04 project requirements	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) 3.11 technical management plan (c) 3.20 verification strategy (b, c) 3.22 validation strategy (b, c) 6.13 project resources and services report (e) 8.10 project team requirements (e)	Human factors integration plan is in 3.09 and 3.11. Verification and validation strategies include the evaluation plan.

Table A.4 (continued)

Process	Input work products	Output work products	Notes
Plan each HCD activity (HCP.3.1.4)	3.11 technical management plan	3.09 project management plan (b, d, e, f) 3.10 project acquisition plan (a, f, g, h) 3.13 project quality plan (c, i)	
Manage HCD activities within the project (HCP.3.1.5)	3.11 technical management plan	6.04 system life cycle model review (d) 6.07 system life cycle process review (d) 6.11 quality management report (a,c) 6.14 project quality report (c,e) 6.15 project progress report (b)	
Identify context of use (HCP.3.2)			
Identify intended user population and differentiate groups of users (HCP.3.2.1)	8.04 project requirements 8.12 stakeholder requirements	2.07 stakeholders profile (a, b) CIF.3 context of use (c, d)	2.07 Includes user group profiles which is a synonym for a target audience description (TAD) and personas.
Identify other aspects of the context of use and reported issues (HCP.3.2.2)	(8.18 human-equipment interface requirements)	CIF.3 context of use description (a, b, c)	Also in 8.12 stakeholder requirements. 8.18 is input for existing systems.
Establish the user requirements (HCP.3.3)			
Identify the user needs (HCP.3.3.1)	CIF.3 context of use description 7.10 operation request	CIF.4 user needs report (a, e) 8.13 stakeholder requirements constraints on solution (c, d, e)	
Specify the user requirements (HCP.3.3.2)	CIF.3 context of use description CIF.4 user needs report	CIF.3 context of use (a) CIF.5 user requirements specification (b, c, e, g, h) 6.21 stakeholder requirements report (a, d, e, f, g, h) 8.16 system technical measures specification (b, c)	Context of use for design
Negotiate the user requirements in the context of a project (HCP.3.3.3)	CIF.3 context of use description CIF.5 user requirements specification 8.13 stakeholder requirements constraints on solution	5.10 stakeholder requirements record (a, b, c) 6.22 system requirements report (c, e) 8.14 system requirements (e, f) 8.15 system requirements constraints on solution (d, e)	
Design solution that meets user requirements (HCP.3.3.4)			

Table A.4 (continued)

Process	Input work products	Output work products	Notes
Specify the user-system interaction (HCP.3.4.1)	CIF.3 context of use 8.13 stakeholder requirements constraints on solution 8.14 system requirements 8.15 system requirements constraints on solution 8.20 implementation constraints on solution 8.26 transition constraints on solution 8.28 validation constraints on solution 8.30 maintenance constraints on solution 8.32 disposal constraints on solution	CIF.7 user interaction specification (b, d, e) 2.08 system functional model (c, f) 8.18 human-equipment interface requirements (a, d, g) 5.1.1 system requirements traceability (a, f)	In 8.17 system interface requirements
Produce and refine interface design solutions (HCP.3.4.2)	CIF.7 user interaction specification CIF.6 evaluation report 8.13 stakeholder requirements constraints on solution 8.15 system requirements constraints on solution 8.18 human-equipment interface requirements 8.20 implementation constraints on solution 8.26 transition constraints on solution 8.28 validation constraints on solution 8.30 maintenance constraints on solution 8.32 disposal constraints on solution 3.11 technical management plan	CIF.8 user interface specification (a, b, c, d, g) 2.09 architectural design description (c, e, g) 8.17 system interface requirements (b)	Technological possibilities are in 8.17 system interface requirements. Refinement includes development of low-fidelity prototypes.
User-centred evaluation (HCP.3.5)			
Plan for evaluation throughout the project (HCD 3.5.1)	3.20 verification strategy 3.22 validation strategy	4.06 verification procedure (a, c, d, e, f) 4.08 validation procedure (a, c, d, e, f) 8.25 Verification enabling system requirement (b, d, e) 8.29 validation enabling system requirements (b, d, e)	Overall V&V procedures

Table A.4 (continued)

Process	Input work products	Output work products	Notes
Plan each evaluation (what to evaluate and how) (HCP.3.5.2)	CIF.5 user requirements specification 3.20 verification strategy 3.22 validation strategy	4.06 verification procedure (a, b, c) 4.08 validation procedure (a, b, c, d) 8.28 validation constraints on solution (b)	Specific V&V protocols Test cases are included in V&V procedures. (e.g. scenarios)
Carry out each evaluation (HCP.3.5.3)	4.06 verification procedure (a,b,c) 4.08 validation procedure (a,b,c)	CIF.6 evaluation report (a) 5.09 stakeholder requirements traceability (b) 6.26 verification report (b, c) 6.28 validation report (b, c)	See ISO/IEC 25062 and ISO/IEC 25066 for details of reporting. Result of evaluation depends on purpose.
Introduction, operation and end of life of a system (HCP.4)			
Introducing the system (HCP.4.1)	CIF.3 context of use description 2.07 stakeholder profile 3.10 project acquisition plan 3.19 integration strategy 3.21 transition strategy 3.22 validation strategy 8.03 supply agreement 8.09 quality measures 8.13 stakeholder requirements constraints on solution	CIF.4 user needs (a) 1.06 qualified operators (g) 1.11 operational system (d, f) 3.07 training strategy (g) 3.12 service management plan (b, e, f) 3.19 integration strategy (c, e, f) 3.21 transition strategy (k, l) 4.04 implementation procedure (a, c, d, e, g) 4.07 transition procedure (e, g) CIF.9 field data report (f, k) 6.02 delivery acceptance report (j) 6.27 transition report (k, l) 8.20 implementation constraints on solution (a, b, c, d) 8.26 transition constraints on solution (a, b, d) 8.27 transition enabling system requirements (b, d, e, g, h)	Includes user documentation (training materials, guides, online support, user awareness programme)

Table A.4 (continued)

Process	Input work products	Output work products	Notes
Human-centred quality in operation (HCP.4.2)	CIF.3 context of use 1.06 qualified operators 1.11 operational system 3.07 training strategy 3.12 service management plan 3.23 operation strategy 5.20 operation record 8.09 quality measures	CIF.9 field data report (a, b, c) 6.03 supply performance report (b, f) 6.10 customer satisfaction report (b, g) 6.16 corrective action report (b, c, f, g) 6.29 operation report (a, b, c) 7.10 operation request (a, b, c, d) 8.17 human-equipment interface requirements (c, d, f, g)	
Human-centred quality during up-grades (HCP.4.3)	CIF.3 context of use description 1.06 qualified operators 3.07 training strategy 3.22 validation strategy 3.24 maintenance strategy 4.07 transition procedure 4.08 validation procedure 5.18 transition record 5.19 validation record 5.21 maintenance record 6.10 customer satisfaction report 7.06 supplier directive 7.10 operation request 8.13 stakeholder requirements constraints on solution 8.17 human-equipment interface requirements 8.09 quality measures	CIF.9 field data report (a, b, e) 1.01 validated system (f) 1.11 operational system (f) 4.10 maintenance procedure (e) 6.03 delivery acceptance report (b, e, f) 6.16 corrective action report (a, e) 6.18 risk management report (e, f) 6.30 maintenance report (c, d, e) 8.30 maintenance constraints on solution (c, e, f) 8.31 maintenance enabling system requirements (c, e)	
Human-centred quality of a system at end of life (HCP.4.4)	3.26 disposal strategy	CIF.3 context of use description (a, b) CIF.9 field data report (c, e) 4.15 disposal procedure (d, f) 5.04 risk register (f) 6.31 disposal report (d, f) 8.32 disposal constraints on solution (b, d, f, g, h) 8.33 disposal enabling systems requirements (d, e, f, g, h)	

Annex B **(normative)**

Tailoring of processes and work products

B.1 General

[Annex B](#) provides requirements and recommendations for tailoring of the processes and work products in this document. It can apply in the following situations:

- a) claims of conformance to adapted processes;
- b) developing a tailored HCD process assessment model for a particular technology or industry;
- c) simplifying or tailoring the HCD processes for implementation in a particular project/company.

The requirements and recommendations in this annex are intended for situation a) and provide useful advice in situations b) and c). For situation b), ISO/IEC 33004 describes the conformance requirements for process models.

B.2 Tailoring process

B.2.1 Purpose

The purpose of the tailoring process is to adapt the processes in this document to satisfy a project or organizational context.

NOTE 1 Organizations establish standard life cycle models as a part of life cycle model management. It can be appropriate for an organization to tailor processes in this document in order to achieve the purposes and outcomes of the stages of a life cycle model to be established.

NOTE 2 Projects select an organizationally established life cycle model for the project as a part of the project planning process. It can be appropriate to tailor organizationally adopted processes to achieve the purposes and outcomes of the stages of the selected life cycle model.

NOTE 3 In cases where projects are directly applying this document, it can be appropriate to tailor processes in this document in order to achieve the purposes and outcomes of the stages of a suitable life cycle model.

B.2.2 Outcomes

As a result of the successful implementation of the tailoring process, modified or new life cycle processes are defined to achieve the purposes and outcomes of a life cycle model.

B.2.3 Activities

If the processes in this document are tailored, then the organization or project shall implement the following activities in accordance with applicable policies and procedures with respect to the tailoring process:

- a) Identify and document the circumstances that influence tailoring. These influences can include, but are not limited to:
 - stability of, and variety in, operational environments;
 - risks, commercial or performance, to the concern of interested parties;

- novelty, size and complexity;
 - starting date and duration of utilization;
 - integrity issues such as safety, security, privacy, human-centred quality, availability;
 - emerging technology opportunities;
 - profile of budget and organizational resources available;
 - availability of the services of enabling systems;
 - roles and responsibilities in the overall life cycle of the system;
 - the need to conform to other standards.
- b) In the case of properties critical to the system, take due account of the life cycle structures recommended or mandated by standards relevant to the dimension of the criticality.
- c) Obtain input from all parties affected by the tailoring decisions. The parties include, but are not limited to:
- the system stakeholders;
 - the interested parties to an agreement made by the organization;
 - the contributing organizational functions.
- d) Make tailoring decisions to achieve the purposes and outcomes of the selected life cycle model.
- e) Select the life cycle processes that require tailoring and delete selected outcomes and activities.

NOTE 1 Irrespective of tailoring, organizations and projects can always implement processes that achieve additional outcomes or implement additional activities and tasks beyond those required for conformance to this document.

NOTE 2 An organization or project can encounter a situation where there is the desire to modify a process of this document. Modification is discouraged in case it has unanticipated consequences on other processes, outcomes or activities. If necessary, modification is best made by deleting the entire process (making the appropriate claim of tailored conformance) and, with careful consideration of consequences, implementing a process that achieves additional outcomes or performs additional activities beyond those of the tailored standard.

B.3 Work product management

The following activities should be performed to specify the required human-centred design work products:

- a) Define the human-centred life cycle process model for the project.
- b) Apply the provisions of the tailoring process to the work products listed in [Annex A](#) to satisfy the project's documentation needs and requirements.

NOTE This step is performed based on applicable agreements and organizational policies.

- c) Apply the provisions of the tailoring process to the work product content described in [Annex A](#) to adapt the tailored set of work products.
- d) Determine which work products are deliverable documents, intermediate deliverables, or non-deliverables, and what work products are to be archived.
- e) Define the title, style, format and schedule of each work product, including provisions for updates of preliminary and intermediate work products.

- f) Define information reuse, configuration management and quality characteristics for each work product.
- g) Define work product review and approval criteria and procedure (including authority, responsibilities and competence).
- h) Determine format and length of retention for each work product.
- i) Include the actions and results of the above activities in the project documentation plan.

Annex C (informative)

Relationship to other human-centred design standards

C.1 General

[Annex C](#) explains:

- in [C.2](#), the relationship between this document and ISO 27500;
- in [C.3](#), the demonstration of conformance to other standards for human-centred design;
- in [C.4](#), the cross-references between ISO 9241-210 and HCPs in this document.

C.2 Relationship to ISO 27500

ISO 27500 describes the significant business benefits that can be achieved by a human-centred organization and explains the risks for the organization of not being human-centred.

This document can assist in achieving one of the ISO 27500 principles of the human-centred approach: to make usability and accessibility strategic business objectives.

This document refers to the following business benefits of a human-centred organization identified in ISO 27500 as part of human-centred quality:

- a) improved operational effectiveness and efficiency and increased likelihood of achieving business objectives in a timely manner;
- b) products and services that are easier to understand and to learn how to use, thus increasing uptake and reducing support costs;
- c) increased accessibility for staff and customers;
- d) reduced risk of poor system, product or service design and the associated financial consequences.

ISO 27500 describes risks of the adverse consequences that can arise from not following a human-centred approach and how they can be managed and mitigated. It includes similar adverse consequences to those in described in [E.2](#).

C.3 Demonstration of conformance to other standards for human-centred design

The International Standards in [Table C.1](#) contain requirements and recommendations for human-centred design and ergonomics with a range of scopes and means of compliance. They can be used as alternative means of demonstrating a conformant approach to human-centred design.

Table C.1 — Other sources of requirements and guidance for human-centred design

Standard	Contents	Conformance
ISO/TS 18152 <i>Ergonomics of human-system interaction — Specification for the process assessment of human-system issues</i>	A process model with more detail than ISO 9241-210 and a wider scope that includes all human-system issues in an organization	Demonstration of conformance to ISO/TS 18152 would use the same approach as in Clause 4 .
ISO 27500 <i>The human-centred organization — Rationale and general principles</i>	Describes the values and beliefs that make an organization human-centred, the significant business benefits that can be achieved, and explains the risks for the organization of not being human-centred.	This is a guidance document, it refers to ISO 9241-210 required activities.
ISO 27501 <i>The human-centred organization — Management of ergonomic processes</i>	Provides requirements and recommendations for managers on the responsibilities they have and the actions to be taken to assist an organization to achieve human centredness.	Conformance with ISO 27501 is achieved by satisfying requirements for management responsibilities in a human-centred organization and specifying the procedure used to determine how they have been met or followed.
ISO 26800 <i>Ergonomics — General approach, principles and concepts</i>	Specifies basic ergonomics principles and concepts. These are applicable to the design and evaluation of tasks, jobs, products, tools, equipment, systems, organizations, services, facilities and environments, in order to make them compatible with the characteristics, the needs and values, and the abilities and limitations of people	If a system, product or service is claimed to have met the requirements, and if the applicable recommendations are considered to have been followed, the procedure used to determine how they have been met/followed should be specified. The detail to which the procedure is specified is a matter of negotiation between the involved parties.
ISO/IEC 2506x series <i>Systems and software product Quality Requirements and Evaluation (SQuaRE) — Common Industry Format (CIF) for usability: General framework for usability-related information</i>	The ISO/IEC 2506x series of International Standards specify the content of a range of reports of usability activities, including context of use specification, user needs report, evaluation reports.	Conformance to the ISO/IEC 2506x series is achieved if a report contains all the required elements.
IEC 62508 <i>Guidance on human aspects of dependability</i>	Provides guidelines in the form of detailed principles and recommendations on human-centred design for dependable systems, i.e. systems that have to perform as and when required.	This is a guidance document.

C.4 Cross-reference between ISO 9241-210 and HCPs in this document

ISO 9241-210 has the same scope as HCP.3. This document sets the ISO 9241-210 principles and activities within an organizational and life cycle context. As ISO 9241-210 provides a simpler model, it can be used to provide an indication of the basic capabilities needed to carry out human-centred design.

[Table C.2](#) maps the listed requirements (“shall”) and recommendations (“should”) in ISO 9241-210:2010, Annex C.1 to the corresponding processes in this document. As many of the requirements and recommendations in ISO 9241-210 refer to activities, the mapping is sometimes to the typical process activities in this document.

NOTE In most cases, the specific activity or outcome in the process is indicated by appending a letter for the outcome or a digit for the activity.

Assessment against the processes in this document can be used as a means of showing conformance to the requirements and applicable recommendations in ISO 9241-210 by using the mapping in [Table C.2](#).

If process assessment is used as a means of showing conformance to the requirements and applicable recommendations in ISO 9241-210, this should be by demonstrating that the process outcome(s) associated with each typical activity have been achieved.

Table C.2 — Cross-reference between ISO 9241-210 and clauses in this document

Clause in ISO 9241-210	Requirement or recommendation	HCP reference
4	Principles of human-centred design	
4.1	Whatever the design process and allocation of responsibilities and roles adopted, a human-centred approach should follow the principles listed below: a) the design is based upon an explicit understanding of users, tasks and environments; b) users are involved throughout design and development; c) the design is driven and refined by user-centred evaluation; d) the process is iterative; e) the design addresses the whole user experience; f) the design team includes multi-disciplinary skills and perspectives.	
4.2	Products, systems and services should be designed to take account of the people who will use them as well as other stakeholder groups including those who might be affected by their use.	HCP.3
4.2	All relevant user and stakeholder groups should be identified. [see also 6.2.2 a)]	HCP.3.2.1
4.3	User involvement should be active.	HCP.3.1.4.g HCP.3.3.1.2
4.3	The users who are involved should have capabilities, characteristics and experience that reflect the range of users for whom the system is being designed. [see also 6.2.2 b)]	HCP.3.3.1.2 HCP.3.5.2.2
4.4	User centred evaluation should take place as part of final acceptance of the product to confirm that requirements have been met.	HCP.3.4.2.d
4.5	Iteration should be used to progressively eliminate uncertainty during the development of interactive systems.	HCD 3.5.1.6
4.6	The users' experience of previous or other systems and issues such as branding and advertising should also be considered.	HCP.3.1.1
4.6	Users' strengths, limitations, preferences and expectations should be taken into account when specifying which activities are carried out by the users and which functions are carried out by the technology.	HCP.3.4.1.c
4.6	Representative users should generally be involved in decisions related to the allocation of function.	HCP.3.4.1.5
4.6	The human activities resulting from the allocation of function should form a meaningful set of tasks.	HCP.3.4.1.4
4.7	Human-centred design teams do not have to be large but the team should be sufficiently diverse to collaborate over design and implementation trade-off decisions at appropriate times.	HCP.3.1.4.h
5	Planning human-centred design	
5.1	Human-centred design shall be planned and integrated into all phases of the product life cycle.	HCP.3.1
5.2	Those responsible for planning the project shall consider the relative importance of usability in the project by evaluating:	
5.2.a)	— how usability relates to the purpose and use of the product, system or service;	HCP.3.1.1
5.2.b)	— the levels of the various types of risk that might result from poor usability;	HCP.3.1.1.e

Clause in ISO 9241-210	Requirement or recommendation	HCP reference
5.2.c)	— the nature of the development environment.	HCP.3.1.3.c
5.3	The planning of human-centred design shall include:	
5.3.a)	— identifying appropriate methods and resources for the activities described in Clause 5;	HCP.3.1.3.b
5.3.b)	— defining procedures for integrating these activities with other system development activities;	HCP.3.1.3.c
5.3.c)	— identifying the individuals and the organization(s) responsible for the HCD activities and the range of skills and viewpoints they provide;	HCP.3.1.3.d
5.3.d)	— developing effective procedures for establishing feedback and communication on HCD activities as they affect other design activities and trade-offs, and methods for documenting these activities;	HCP.3.1.4.f
5.3.e)	— agreeing on appropriate milestones for human-centred activities integrated into the overall design and development process;	HCP.3.1.4.6
5.3.f)	— agreeing on suitable timescales to allow iteration, use of feedback, and possible design changes, to be incorporated into project schedule.	HCP.3.1.4.e
5.4	The plan for human-centred design shall form part of the overall system development project plan.	HCP.3.1.3.c
5.4	To ensure that it is followed through and implemented effectively the plan for human-centred design should be subject to the same project disciplines (e.g. responsibilities, change control) as other key activities	HCP.3.1.4.e
5.4	The HCD aspects of the project plan should be reviewed and revised as requirements change as appropriate throughout the life of the project.	HCP.3.1.5.d
5.5	Project planning shall allocate time and resources for the human-centred activities.	HCP.3.1.4.a
5.5	[The plan] shall include time for iteration and the incorporation of user feedback, and for evaluating if the design solution satisfies the user requirements.	HCP.3.1.4.1
5.5	Additional time should be allocated for communication among design team participants and for reconciling potential conflicts and trade-offs that involve human-system issues.	HCP.3.5.1.e
5.5	Human-centred design activities should start at the earliest stage of the project.	HCP.3.1.3.c
5.5	The HCD aspects of the project plan should be reviewed throughout the life of the project.	HCP.3.1.5.d
6	Human-centred design activities	
6.1	There are four linked HCD activities that shall take place during the design of any interactive system	
6.1.a)	— Understand and specify the context of use.	HCP.3.2
6.1.b)	— Specify the user requirements.	HCP.3.3
6.1.c)	— Produce design solutions.	HCP.3.4
6.1.d)	— Evaluate	HCP.3.5
6.2.2.a)	Relevant groups shall be identified and their relationship with the proposed development described in terms of key goals and constraints.	HCP.3.2.1.a
6.2.2.b)	Relevant characteristics of the users shall be identified.	HCP.3.2.1.a
6.2.2.b)	If necessary, the characteristics of different types of users should be defined	HCP.3.2.1.a
6.2.2.b)	In order to achieve accessibility, products, systems and services should be designed to be used by people with the widest range of capabilities in intended user populations.	HCP.3.1.1.c
6.2.2.c)	The task goals of the users and the overall goals of the system shall be identified.	HCP.3.1.1 HCP.3.2.2.a

Table C.2 (continued)

Clause in ISO 9241-210	Requirement or recommendation	HCP reference
6.2.2.c)	The characteristics of tasks that can influence usability and accessibility shall be described.	HCP.3.2.2.a HCP.3.4.1
6.2.2.c)	Any potential adverse consequences for health and safety should be identified	HCP.3.1.2.g
6.2.2.c)	If the task can be completed incorrectly, this should be identified	HCP.3.1.2.4
6.2.2.c)	Tasks should not be described solely in terms of the functions or features provided by a product or system.	HCP.3.2.2.a
6.2.2.d)	The technical environment, including the hardware, software and materials, shall be identified.	HCP.3.2.2.a
6.2.2.d)	The relevant characteristics of the physical, social, organizational and cultural environment shall be described.	HCP.3.2.2.a
6.2.3	The context of use of the system should be described in sufficient detail to support the design activity.	HCP.3.2.2.a
6.2.4	The intended context of use should be specified as part of the user requirements specification to clearly identify the conditions under which the requirements apply	HCP.3.3.2.a
6.3.1	Identifying user needs and specifying the functional and other requirements for the product or system should be extended to create an explicit statement of user requirements in relation to the intended context of use and the business objectives of the system.	HCP.3.3.1 HCP.3.3.2
6.3.1	If the proposed interactive system will impact on organizational practice the development process should involve organizational stakeholders in the design process with the aim of optimising both the organizational and technical systems.	HCP.3.1.4.8
6.3.2	User and other stakeholder needs should be identified, taking account of the context of use.	HCP.3.3.1
6.3.2	User and other stakeholder needs should include what users need to achieve (rather than how) and any constraints imposed by the context of use.	HCP.3.3.1.3 HCP.3.3.1.4
6.3.3	The specification of user requirements shall include:	
6.3.3.a)	— the intended context of use;	HCP.3.3.2.a
6.3.3.b)	— requirements derived from the user needs and the context of use;	HCP.3.3.2.c
6.3.3.c)	— requirements arising from relevant ergonomics and user interface knowledge, standards and guidelines;	HCP.3.3.2.3
6.3.3.d)	— usability requirements and objectives including measurable usability performance and satisfaction criteria in specific contexts of use;	HCP.3.3.2.b
6.3.3.e)	— requirements derived from organizational requirements that directly affect the user.	HCP.3.3.2.7
6.3.4	Potential conflicts between user requirements should be resolved.	HCP.3.3.2.5
6.3.4	The rationales for any trade-offs should be documented so that they can be understood in the future.	HCP.3.3.3.6
6.3.5	The user requirements specification should be:	
6.3.5.a)	— stated in terms that permit subsequent testing;	HCP.3.3.2.g
6.3.5.b)	— verified by the relevant stakeholders;	HCP.3.3.3
6.3.5.c)	— internally consistent;	HCP.3.3.3.c
6.3.5.d)	— updated as necessary, during the life of the project.	HCP.3.5.1.a HCP.3.5.2.1
6.4.1	Producing design solutions should include the following sub-activities:	
6.4.1.a)	— designing user tasks, interaction and interface to meet the user requirements, considering the overall user experience;	HCP.3.4.1

Table C.2 (continued)

Clause in ISO 9241-210	Requirement or recommendation	HCP reference
6.4.1.b)	— making the design solutions more concrete;	HCP.3.4.2
6.4.1.c)	— altering the design solutions in response to user centred evaluation and feedback;	HCP.3.4.2.10
6.4.1.d)	— communicating the design to those responsible for implementation.	HCP.3.4.2.11
6.4.2.1	The following principles (taken from ISO 9241-110) should be taken into account when designing interactive systems:	
6.4.2.1.a)	— suitability for the task;	HCP.3.3.2.4
6.4.2.1.b)	— self-descriptiveness;	HCP.3.3.2.4
6.4.2.1.c)	— conformity with user expectations;	HCP.3.3.2.4
6.4.2.1.d)	— suitability for learning;	HCP.3.3.2.4
6.4.2.1.e)	— controllability;	HCP.3.3.2.4
6.4.2.1.f)	— error tolerance;	HCP.3.3.2.4
6.4.2.1.g)	— suitability for individualization.	HCP.3.3.2.4
6.4.2.2	Designing the interaction should include:	
6.4.2.2.a)	— making high level decisions;	HCP.3.4.1.a
6.4.2.2.b)	— identifying tasks and sub-tasks;	HCP.3.4.1.b
6.4.2.2.c)	— allocating tasks to user and system;	HCP.3.4.1.d
6.4.2.2.d)	— identifying the interaction objects required for the completion of the tasks;	HCP.3.4.2.3
6.4.2.2.e)	— identifying appropriate dialogue techniques;	HCP.3.4.2.2
6.4.2.2.f)	— designing the sequence and timing (dynamics) of the interaction;	HCP.3.4.2.3
6.4.2.2.g)	— designing the information architecture of the user interface of an interactive system to allow efficient access to interaction objects.	HCP.3.4.2.4
6.4.2.3	Ergonomics and user interface knowledge, standards and guidelines should be used to inform the design of both hardware and software of the user interface.	HCP.3.4.2.5
6.4.3	The level of detail and realism [of prototypes] should be appropriate to the issues that need to be investigated.	HCP.3.4.2.6
6.4.4	Feedback from evaluation should be used to improve and refine the system.	HCP.3.4.2.8
6.4.4	The costs and benefits of proposed changes should be evaluated and used to inform decisions about what will be modified.	HCP.3.4.2.8
6.4.4	Project plans should allow sufficient time for making the changes as a result of such feedback.	HCP.3.1.4.e
6.4.5	There should be some sustained channel of communication between those responsible for human-centred design and other members of the project team.	HCP.2.1.4
6.4.5	When design solutions are communicated, they should be accompanied by an explanation and justification of the design decisions especially where trade-offs are necessary.	HCP.3.1.4.e
6.4.5	The communication [of details of the design] should take account of the constraints imposed by the project and the level of knowledge and understanding about ergonomics and user interface design.	HCP.3.1.5
6.5.1	User centred evaluation is a required activity in human-centred design.	HCP.3.5
6.5.1	Even at the earliest stages in the project, design concepts should be evaluated to obtain a better understanding of the user needs.	HCP.3.4.2.8 HCP.3.5.1.1
6.5.1	If user-based testing is not practical or cost effective at a particular stage of a project, design solutions should be evaluated in other ways.	HCP.3.5.1.c
6.5.2	User centred evaluation should involve:	
6.5.2.a)	— allocating resources both for obtaining early feedback to improve the product, and later for determining if requirements have been satisfied;	HCD 3.5.1.a

Table C.2 (continued)

Clause in ISO 9241-210	Requirement or recommendation	HCP reference
6.5.2.b)	— planning the user centred evaluation so that it fits the project time schedule;	HCD 3.5.1.e
6.5.2.c)	— sufficiently comprehensive testing to give meaningful results for the system as a whole;	HCP.3.5.3.2
6.5.2.d)	— analysing the results, prioritizing issues and proposing solutions;	HCP.3.5.3.3/4
6.5.2.e)	— communicating the solutions appropriately so that they can be used effectively by the design team.	HCP.3.5.3.c
6.5.3	To obtain valid results, the evaluation should be carried out by experienced practitioners, (and)	HCP.3.1.4.i
6.5.3	[To obtain valid results the evaluation] should use appropriate methods.	HCP.3.5.1.c
6.5.3	Resources for evaluation should be allocated both for obtaining early feedback to improve the product, and later for determining if requirements have been satisfied.	HCP.3.5.1.4
6.5.3	The scope of this latter (summative) evaluation should depend on the extent of the risks associated with not meeting requirements.	HCP.3.5.1.5
6.5.4	When prototypes are used, they should be used to collect user feedback while carrying out tasks rather than just being demonstrations to show users a preview of the design.	HCP.3.5.2.4
6.5.6	A HCD process should include long term monitoring of the use of the product, system or service.	HCP.4.2
6.5.6	Criteria and measurements [for long term monitoring] should be sensitive enough to identify system failure, or system problems, as early as possible.	HCP.4.1 HCP.4.2

Annex D **(informative)**

Uses of the document

D.1 Uses of the process descriptions

D.1.1 General

This clause elaborates the situations in which the processes described in this document can be used. These are summarized in [8.1](#).

D.1.2 Implementing human-centred design

The human-centred process model in this document describes a complete set of the processes that can be used to make interactive systems human-centred. This makes it a useful resource for enterprises (organizations, departments or projects) designing a system development process and/or support life cycle that needs to be human-centred.

This implementation is a challenging endeavour. Besides the more “technical” aspect (the new approach to development based on organizational needs for human-centred quality and the expected benefits), the implementation takes into account the capabilities, knowledge, beliefs, expectations and motivations of all people involved. These people include end users, developers, product managers, executive management and goes up to the board. This involves making clear how the execution of human-centred design is valued and respected on every level of the organization. An organizational change management process (communication, persuasion, education) facilitates achievement of the expected results.

The preferred approach is for the enterprise to set up a procedure to define their needs for human-centred design. The processes described in this document provide the basis for this procedure. The outcomes of the processes in this model (and other models) are compared with the organization’s needs for human-centred design.

The next step is to define a life cycle that implements and integrates the base and management process activities to the required level to achieve the business purposes of the organization, department or project (see the ISO/IEC 24748 series). The lists of work products in [Annex A](#) assist in this definition. It is important that there is a surrounding process to incorporate it in the organizational culture. Further information about human-centred organizations can be found in ISO 27500 and related standards.

More detailed information on most of the process activities is provided in ISO 9241-210. Advice on the particular methods that implement these activities is available from textbooks and human factors service providers.

D.1.3 Assessing an enterprise’s existing capability to carry out the human-centred processes

The model presented in this document can be used in the assessment of an enterprise’s capability to carry out the human-centred processes described in the model. This enterprise can be an internal sub-organization (e.g. an IT department) or a system supplier. The intended assessment process is that defined in ISO/IEC 33000 family of standards. The reader is referred to ISO/IEC 33000 family of standards for details of the qualification of assessors, quality processes associated with assessments, etc.

The first step is the adaptation of the model for the assessment. This consists of selection of relevant processes and definition of the maximum capability that is likely to be observed. The processes selected are representative of the activities carried out by the enterprise.

For internal process improvement the purpose of assessment is usually to gain a clear picture of the processes in a particular enterprise for the purpose of process improvement. The benefit to the enterprise is best realized if the model is adapted to suit the purposes of the assessment. Processes and activities are selected for assessment if the enterprise wishes to know how well that particular process is carried out. If it is not important to the business that a particular process is performed well then there is no need to assess it.

In a third party assessment for the purposes of accreditation, the situation is different. A purchaser or other client is looking for evidence that the processes that it considers necessary are performed to the level it requires. In this case the processes to be covered are defined by the client and any adaptation has to be justified and agreed.

The next step is to select typical projects for assessment. For a thorough assessment, the range of projects are selected to be representative of the spread of work, size of project and diligence of the enterprise.

The assessment itself can be achieved by various approaches, including interviewing selected staff, to ascertain how many of the activities are performed for each process and the degree to which outcomes are achieved. The work products described in [Annex A](#) can be used as evidence of the performance of the practices. If necessary, the level of maturity of performance of the processes can also be determined using the management practices described in the ISO/IEC 33000 family of standards.

The enterprise being assessed needs to understand and prepare for the assessment. In an ideal case, the relevant staff will have studied the model and prepared a description of how the enterprise's processes and activities map onto the human-centred life cycle processes.

D.1.4 Improving the application of human-centred design as part of an existing system development process

The human-centred processes, the activities and the work products provide a description of how enterprises carry out activities that take account of user issues. The ISO/IEC 33000 family of standards presents a number of levels of maturity with regard to these processes. These descriptions can be used in setting the agenda and goals for improvement of a human-centred approach in systems development. The management practices provide a description of what is required in order to take the next step in increasing the maturity of the enterprise with respect to a human-centred approach.

Assessments are required to diagnose existing process capability and to monitor performance. However, the goal of process performance is business benefit, not a score or certificate. The best approach to assessment for the purpose of process improvement is for the enterprise to define a desired profile of performance in human-centred processes based on their business need. The scope of initial and monitoring assessments is then designed to match that profile.

The assessment approach described in ISO/IEC 33000 family of standards is rigorous and is intended to give reproducible results across a variety of enterprises.

The model can also be used beneficially in a more informal setting, such as a workshop or discussion group. A description of the development process and the discussion about whether or not the management practices are performed is retained, but the scoring does not need to be introduced or, if it is, the assessment as to whether attributes are performed or not, would become a group decision. The result does not need to be recorded, but a general agreement is reached about the achieved level, the required level for the business or project, and the actions required to attain it.

A discussion group approach is intended to increase awareness amongst participants. Their discussion with each other in the assessment meeting can well be more valuable than recommendations given by improvement experts. When assessment is carried out by external assessors an element of group discussion can be built in, to promote awareness and organizational learning. Using a discussion group

approach, a project can assess itself and retain the results for comparison with their next discussion or project; improvement actions should still be planned, and responsibility for making changes allocated.

The human-centred processes presented in this document can be used to augment the set of processes in other process models. This augmentation is likely to be made when a capability assessment is being performed on an organization or department that develops or supports systems that gain business benefit from meeting the needs of their users.

The human-centred processes for a particular assessment can be selected and adapted using the tailoring process described in [Annex B](#). The processes are described in a standard format in order to make this process as easy as possible. It is advisable to take advice from a human factors expert when selecting processes to include in the assessment.

D.1.5 Development of competence in human-centred design

Competence can be seen in terms of two dimensions or axes. One axis is the set of processes considered relevant to the discipline of interest, in this case the processes in this document. The other axis defines the levels of proficiency in performing these processes; typically using a progression of increasing-value cardinal points that are defined in terms of attainment or performance criteria. The model in this document can be used to identify appropriate content for education and training courses in human-centred design and usability.

D.2 Organizational context for implementing human-centred design

This document can be applied to implement human-centred design in a wide range of organizational contexts described below.

a) Degree of formality

- Governance-centred organizations employ governance and management systems (usually based on standards such as ISO/IEC 38500, ISO 9001, ISO/IEC 20000-1) as a tool for control. This document, particularly in HCP.1 and HCP.2, embodies this approach to management. Recognition of this approach facilitates the uptake of human-centred design in such organizations.
- Less formal organizations; that take a more ad-hoc or trust-based approach to management can use this material as informal guidance on the management of enterprise risk.

b) Manufacturers and acquirers

- Manufacturers of systems: need to be human-centred in designing both custom systems for individual clients and systems to be sold off-the-shelf, whether as complete systems or as components of larger systems.
- Acquirers of systems: retain most of the responsibility for ensuring that a system meets user needs. A process perspective makes this clearer and assists communications between parties. It is particularly important when off-the-shelf systems and components to be integrated into systems are being acquired.

c) Large and small organizations

- In large organizations, activities and responsibilities are fragmented between groups/departments. In small organizations, a small number of people carry out all activities. In both cases, this document provides clarity regarding what needs to be done and why, independent of structure or individual skills.

d) Introduction and improvement of human-centred design

- Introducing human-centred design when there are no existing HCD processes.
- Improving existing HCD processes.

- e) Top-down and bottom-up application of human-centred design
 - Top-down application of human-centred design follows the order of description of processes.
 - Bottom-up application of human-centred design starts from the technical processes (HCP.3) and, as the need for formality and support develops, the management and governance processes become useful.
- f) System and service providers
 - System providers are responsible for designing, integrating and implementing all parts of a usable system with which user interact within an organization. This is carried out as a project and is common in the transport, manufacturing, energy and defence sectors and to some degree public sector systems. This document provides a template for project activities and the deliverables necessary for communication about user needs and human-centred quality.
 - Services have requirements for human-centred quality. These can be met through a human-centred approach. In corporate IT, information services, entertainment, and social media functionality is assembled from generic components. In this context, what is managed is a service, and the human-centred quality of a service is a more dynamic attribute. In the service context, this document provides a set of objectives for monitoring user needs and maintenance of quality.

NOTE Human-centred design can be used to identify and contribute to the value provided by a service.

NOTE See ISO 27500 for more information on opportunities, and managing and mitigating organizational risks, related to human-centred design.

Annex E (informative)

Human-centred quality

E.1 General

Human-centred quality is a collective term for the intended outcomes of interaction with a product, system or service. It is defined as the extent to which requirements for usability, accessibility, user experience and avoidance of harm from use are met. Human-centred design can be used to identify and formalize a range of requirements for usability, accessibility, user experience and avoidance of harm. Human-centred quality results from interaction or anticipated interaction with an interactive system (including aesthetic appreciation). [Figure E.1](#) illustrates the interrelationship between the components of human-centred quality and summarizes the type of outcome for each. Provision of the necessary technical functionality is a prerequisite for human-centred quality.

NOTE For any design solution, usability, accessibility, user experience and avoidance of harm are interrelated. Identifying all requirements related to human-centred quality is more important than identifying which component of human-centred quality a particular requirement belongs to.

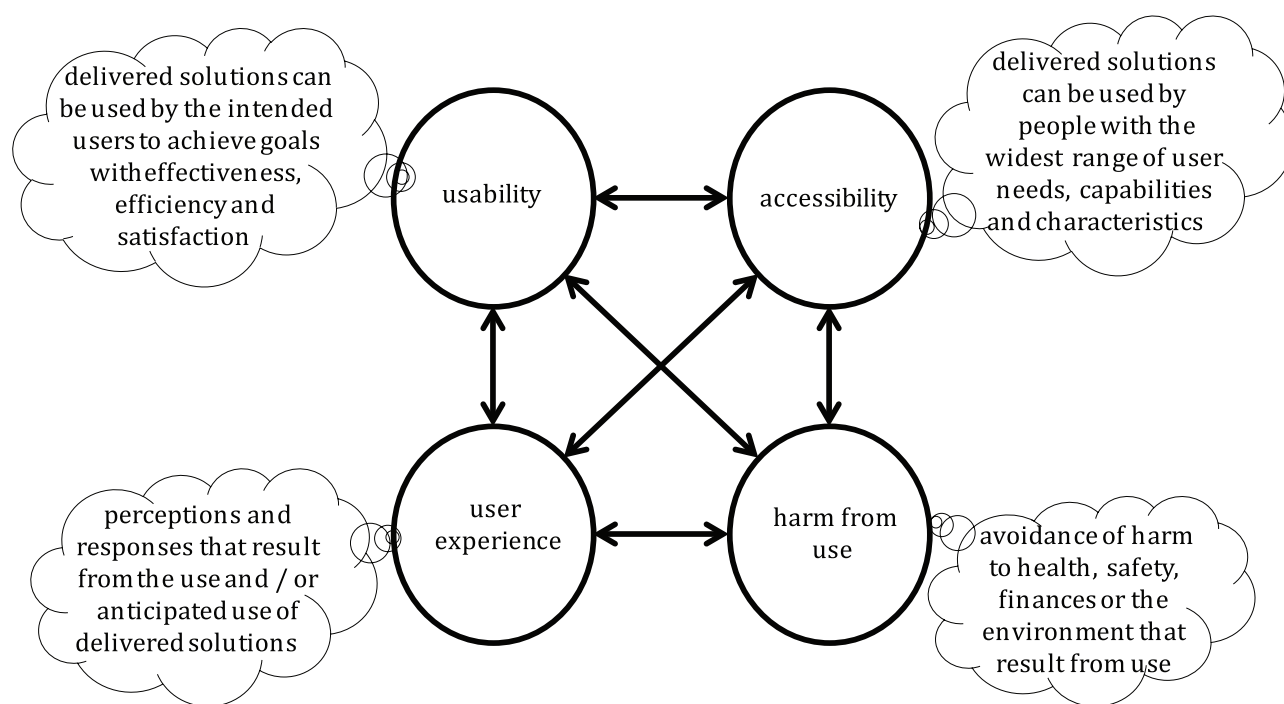


Figure E.1 — Human-centred quality

The purpose of human-centred design is to achieve and sustain an interactive system that meets defined requirements for human-centred quality. Human-centred design also contributes to the management of uncertainty more broadly. This is described in [Annex F](#).

There are specific applications of human-centred quality related to usability (e.g. learnability, maintainability), of user experience (e.g. privacy, security and trustworthiness) and of harm (e.g. safety) (see [E.6](#)).

E.2 Usability

Usability is the extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.

The extent to which usability is achieved varies depending on the combination of factors. The same system, product or service can have significantly different usability depending on the goals, the types of users and other components of the context of use. Usability is influenced by the users' characteristics, capabilities and other individual differences, and by the characteristics of the tasks that they perform, and can depend on the physical, social, cultural and organizational environments.

Usability is typically considered in relation to a system, product or service that is being designed or evaluated in a given context of use.

E.3 Accessibility

Accessibility is the extent to which products, systems, services, environments and facilities can be used by people from a population with the widest range of user needs, characteristics and capabilities to achieve identified goals in identified contexts of use. The aim in designing for accessibility is to widen the target population, thus making products, systems, services, environments and facilities more accessible to more people in more diverse context of use.

ISO/IEC Guide 71 identifies a set of high-level user accessibility needs which are intended outcomes of interactions and which are related to 11 accessibility goals (suitability for the widest range of users; conformity with user expectations; support for individualization; approachability; perceivability; understandability; controllability; usability; error tolerance; equitable use; and compatibility).

ISO/IEC TR 29138 provides a detailed description of IT related user accessibility needs.

ISO/IEC 30071-1¹⁾ provides a code of practice for creating accessible ICT products and service.

ISO 9241-171 provides additional guidance on software accessibility and ISO/IEC 29136 provides additional guidance on hardware accessibility.

E.4 User experience

User experience is a person's perceptions and responses that result from the use and/or anticipated use of a system, product or service. User experience focuses on the user's preferences, attitudes, emotions and physical and psychological responses that occur before, during and after use. A positive user experience, especially in terms of how easy or pleasing an interactive system is to use, can provide value to the user and/or to the organization that provides the interactive system.

As part of human-centred quality, user experience is the extent to which requirements are met for particular perceptions and/or responses resulting from the use of the interactive system (for example sympathetic warning messages intended to alleviate stress). The requirements for the user experience of a user group or an individual using an interactive system can be specified as part of design and development and are based on the user needs.

The accumulated experience of a user can influence how they experience a particular interactive system, e.g., establishing perceptions before a user uses an interactive system for the first time.

Human-centred design can only manage user experience that results from designed aspects of the interactive system. It has less control over aspects of user experience that result from context of use issues such as marketing, culture, or societal expectations. However, HCD activities can identify

1) Under preparation. (Stage at the time of publication: ISO/IEC FDIS 30071-1).

negative outcomes related to these issues. For this reason, it may not be possible to set requirements for all aspects of user experience.

NOTE The term “user experience” is sometimes used to refer to all the aspects of users interacting with the system. When used in this way, the term is equivalent to the whole of human-centred quality.

E.5 Harm from use

E.5.1 General

Harm from use is the negative consequences for health, safety, finances or the environment that can result from use of the system, product or service. Human-centred design can help reduce the risk of harm from use arising from inadequate usability, accessibility of user experience (see [Annex F](#)).

Examples of the harm that can result from use are listed below for different types of stakeholders.

E.5.2 Harm to the user

Use of the interactive system can result in the following types of harm to the user.

- a) The immediate effects of inadequate usability, accessibility or user experience:
- poor usability (e.g. failing to adequately complete a task, taking too much time, dissatisfaction resulting in unwillingness to use the system again);
 - poor accessibility (e.g. elderly users are unable to carry out tasks because they cannot learn (and thus recall) the passwords needed to log in to the application) or
 - poor user experience (e.g. frustration after repeated unsuccessful attempts to complete a task).
- b) Physical hazards arising from use, e.g. health and safety risks, consequences of fatigue or excess workload.

EXAMPLE Users find that a guard on a machine makes it more difficult to carry out a task so they disable the guard increasing the risk that an accident will occur.

- c) Defects in usability or accessibility that prevent the overall purpose(s) of use of the system of interest being achieved; resulting in inconvenience, physical or financial harm, compromised security, etc.

EXAMPLES

Inadequate usability results in mistakenly booking a ticket for the wrong date.

Inadequate usability results in the clinical users making errors that lead to patients receiving the wrong treatments.

Inadequate accessibility results in the exclusion of a significant proportion of the intended users from being able to use the on-line system.

Instructions for security settings are unreadable or difficult to find resulting in unauthorized access to an email account.

- d) Consequences of inadequate user experience.

EXAMPLES

Lack of trust, security or privacy.

A frustrating user experience with a consumer product results in the product not being used.

E.5.3 Harm to the organization using the interactive system

Use of the interactive system within an organization can result in the following types of harm.

- a) Damage to an organization's reputation or finances resulting from use errors.

EXAMPLE An organization suffers reputational and financial damage as a result of an interruption to services resulting from an error made by a person carrying out maintenance work

- b) Inadequate operational safety or protection of security or privacy.
- c) Loss of productivity due to users performing workarounds and avoiding the system.
- d) Inadequate accessibility resulting in higher staff costs.

EXAMPLE A transport company continues to maintain manned ticket offices because its automated ticketing systems are not accessible.

- e) Inadequate usability resulting in data corruption.

E.5.4 Harm to the organization supplying or acquiring the interactive system

An inadequate interactive system can result in the following types of harm to the organization supplying or acquiring the system.

- a) The design and development of the system does not meet intended targets for usability, accessibility, and/or user experience.
- b) The delivered system does not support operational needs in an organization.
- c) Economic or reputational consequences to the supplying organization resulting from a delivered system not being purchased or a service not being used.
- d) Financial costs of rework to address shortcomings.
- e) A lack of agreement on solutions (within and across user groups).
- f) The consequence of inadequate operational safety or protection of security or privacy.

E.5.5 Harm to other stakeholders

Potentially, there can be negative consequences for more distant stakeholders such as wider society and the environment.

- a) Harm to the environment and evacuation of the local area resulting from use errors in a chemical plant.
- b) Unnecessarily high level of public expenditure due to design failing to address human centred quality.

E.6 Specific applications of human-centred quality

Learnability, maintainability, privacy, security, trustworthiness and safety are all outcomes that are specific applications of human-centred quality.

Outcomes of usability

- a) Learnability: Learnability as an outcome is the effectiveness, efficiency and satisfaction with which users achieve the goal of learning to be able use a system. Learnability is an important factor for new and occasional users.

- b) **Maintainability:** Maintainability is the usability of meeting maintenance goals for a system. Maintainability is important for systems that can need support or repair (especially systems with a physical component).

Outcomes of user experience

Perceptions of privacy and trustworthiness can result from positive experience of use of a system.

Outcomes of avoidance of harm from use

Safety is an example of avoidance of harm. There are, broadly, two safety perspectives related to people.

- a) **Occupational safety and health** — identifying and addressing conditions inherent in the operation or use of a system (e.g. fatigue, stress) which can cause injury, illness, or reduce the performance of personnel.
- b) **System safety** — applying human-centred design to minimize safety risks occurring as a result of the system being operated or functioning in either a normal or reasonably foreseeable abnormal manner.

Freedom from dissent is an example of avoidance of harm: agreement on solutions (within and across user groups) so that delivered solutions do not cause dissent within and across user groups.

E.7 Relationship to quality in use in ISO/IEC 25010:2011

Quality in use is defined in ISO/IEC 25010:2011 as the degree to which a product or system can be used by specific users to meet their needs to achieve specific goals with effectiveness, efficiency, freedom from risk and satisfaction in specific contexts of use. [Table E.1](#) compares quality in use and human-centred quality. The differences are:

- human-centred quality relates to meeting requirements, quality in use to meeting user needs;
- accessibility and user experience are explicit in human-centred quality, while in quality in use they are only implicit through other definitions;
- avoidance of harm relates to harm arising from use of the product or system, while risk of negative consequences can arise from any aspect of the quality of the product or system.

Table E.1 — The components of human-centred quality and quality in use

	Human-centred quality	Quality in use
Definition	Extent to which requirements for usability, accessibility, user experience and avoidance of harm from use are met	Degree to which a product or system can be used by specific users to meet their needs to achieve specific goals with effectiveness, efficiency, freedom from risk and satisfaction in specific contexts of use
Criteria	Requirements	User needs
Includes usability (effectiveness, efficiency and satisfaction)?	✓	✓

Human-centred quality		Quality in use
Includes accessibility?	✓	Implicitly included, as accessibility is defined as: “degree to which a product or system can be used by people with the widest range of characteristics and capabilities to achieve a specified goal in a specified context of use”
Includes user experience?	User's perceptions and responses that result from the use and/or anticipated use of a system, product or service	Implicitly included as the sub characteristics of satisfaction are: usefulness, trust, pleasure and comfort
Avoidance of harm from use and Freedom from risk	Avoidance of harm from use: “avoidance of negative consequences regarding health, safety, finances or the environment that result from use of the system”	Freedom from risk: “degree to which a product or system mitigates the potential risk to economic status, human life, health, or the environment”

Table E.1 (continued)

Annex F
(informative)

Risk management and human-centred design

F.1 General

Risk management is about managing the uncertainty that can result from outcomes that deviate from the expected. Deviations include negative outcomes, positive outcomes (that can provide opportunities), or different outcomes (such as dissent among stakeholders). In this document, the phrase “avoidance of harm” is used to refer to mitigation of undesirable deviations.

Risk management increases the probability of success in achieving objectives and reduces both the probability of failure and the level of uncertainty associated with achieving the objectives of the project.

In the context of human-centred design, risk arises from the uncertainty about the outcomes of interaction with a system achieving the expected or required levels of usability, accessibility and user experience. This uncertainty is reduced through human-centred design. Human-centred design provides information that can be used to maximize the likelihood and benefits of opportunities and minimizes the likelihood and consequence of threats.

Measures of human-centred quality should include a minimum planned acceptable value to avoid negative consequences (Figure F.1). Negative consequences are “harm” to the user or organization related to or arising from defects in usability, accessibility or the user experience; including consequences for economic status, human life, health, or the environment. Different usability, accessibility and user experience defects can have different implications for negative consequences: human-centred design helps to identify the consequence and severity of the problem.

NOTE Investment to produce values above planned acceptable levels may not be beneficial, but in some cases, provides opportunities.

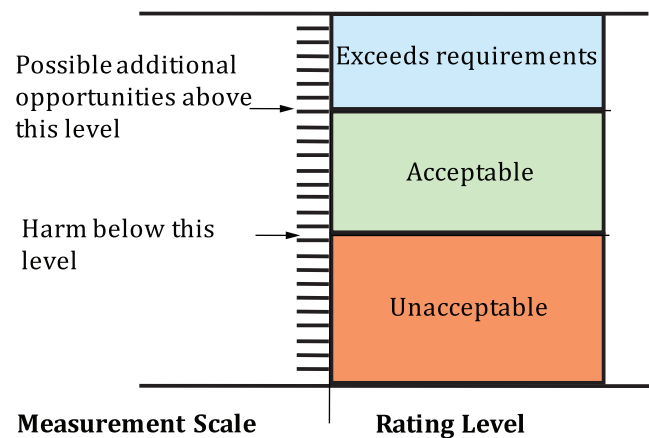


Figure F.1 — Threats and opportunities associated with the level of quality

This annex addresses the mitigation of negative consequences. Beyond the benefits listed in Clause 5, opportunities related to human-centred design tend to be specific to the interactive system.

F.2 Avoiding harm through human-centred design

F.2.1 General

This subclause addresses the management of risk for users and related stakeholders and organizations. Negative consequence for more distant stakeholders, society and the environment tend to be consequential on system failures and are addressed in standards such as ISO 27500, ISO 26000 and the ISO 14000 family of standards.

NOTE 1 Human-centred design can only manage risk relating to human use of interactive systems. Some of this risk can also be caused by issues and deficiencies that are the responsibility of other stakeholders; such as those responsible for marketing, safety, engineering, support, and organizational design. HCD activities can sometimes identify negative outcomes related to these deficiencies (For example, inability to complete a task quickly enough as a consequence of inadequate speed of performance of the interactive system, or deficiencies in training efficiency).

Threats can be emergent and are identified by HCD activities that analyse usability, user experience and accessibility, rather than specific, pre-identified design objectives.

NOTE 2 In addition to identifying usability, accessibility or user experience defects, human-centred design can also identify the potential severity of the consequence of a defect, its likelihood and the importance of preventing it occurring.

NOTE 3 In ISO 9241-11, effectiveness is the correctness and completeness with which users achieve specified goals, and correctness is the extent to which actual outcomes match intended outcomes and no outcomes lead to undesirable negative consequences.

F.2.2 Design strategies for mitigation of risk

Provision of necessary functionality, improved usability, accessibility and user experience can remove or mitigate negative consequences for users, other stakeholders, society and the environment that results from interactive systems that do not take account of the user's needs.

In human-centred design, errors in the use of an interactive system are referred to as “use errors” rather than “human errors”. A foundational principle of human-centred design is that use errors arise from a mismatch between the human’s capabilities/limitations and the designed system. Use errors can be mitigated through the proper design of the system, not by blaming humans for making errors during use. If use errors cannot be eliminated in design, harm resulting from use errors can be mitigated by means of:

- error prevention on the user interface, i.e. not allowing specific use errors to be made by the user (“inherent safety”);
- protective measures on the user interface (e.g. system feedback to the user of a medical device on inappropriate connection of tubes);
- information for safety on the user interface and/or user documentation.

F.2.3 Management of organizational threats

[Table F.1](#) lists the types of organizational threat managed by the target audiences, in each process category.

Table F.1 — Audiences, and types of threat for each process category

Process category	Type of organizational threats addressed
HCP.1 Ensure enterprise focus on human-centred quality	Image/society Business survival Human-system issues in governance Human-system issues in services
HCP.2 Enable human-centred design across projects and systems	Lack of resource Inappropriate organizational objectives Human-system issues in programme Human-system issues across systems
HCP.3 Execute human-centred design within a project	Human-system issues in project Quality of system Technical defects Human-system issues in the system
HCP.4 Introduction, operation and end of life of a system	Operational Human-system issues in services Quality of service

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