**Table 19** *(continued)*

| | |
|---|---|
| | 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] |
| | 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]<br><br>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. |
| | 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] |
| | 11) Iteratively adapt the concept based on the findings of user-centred evaluation until an acceptable cost-effective solution is obtained. [e, f]<br><br>   i) Take account of the costs and benefits of proposed changes when deciding what will be modified.<br><br>   ii) Decide (using HCP.3.5) if the user interface design solution sufficiently meets the user requirements. |
| | 12) Communicate the acceptable solution to the development team, based on the user requirements and tasks to be supported by the solution. [g]<br><br>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. |

## 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 proto-types, 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 | a) Evaluation to achieve the following purposes is planned as part of the referenced processes. <br><br>    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). <br><br>    ii) Evaluation of prototypes in order to check that ergonomic guidance has been followed (HCP.3.4.2). <br><br>    iii) Evaluation of prototypes in order to improve the design (HCP.3.4.2). <br><br>    iv) Evaluation of prototypes to check that the user, other stakeholder and organizational requirements have been met (HCP.3.4.2). <br><br>    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). <br><br>    vi) Evaluation in order to identify usability problems (HCP.3.4.2, HCP.4.1, HCP.4.3). <br><br>    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). <br><br> b) The aspects of human-centred quality to be evaluated are decided. <br><br> c) Appropriate methods and degree of user involvement to be employed for evaluation are agreed on (ISO/IEC 25066 describes different types of evaluation). <br><br> d) The work products to be delivered for each evaluation activity are specified. <br><br> 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. <br><br> f) Iterative evaluation is carried out if necessary. |

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**Table 20** *(continued)*

| Process activities (typical) | |
|---|---|
| | 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]. |
| |    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] |

### 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 | a) The objectives of the evaluation are identified.<br><br>b) The methods and work products for conducting the evaluation are agreed.<br><br>c) The inspection-based or user-based evaluation is prepared appropriately.<br><br>   i) All relevant aspects of human-centred quality are included.<br><br>   ii) The evaluation is based on a realistic context of use.<br><br>   iii) The evaluation is scheduled.<br><br>d) Stakeholders are involved as appropriate. |
| Process activities (typical) | 1) Identify the intended outcomes of the specific evaluation, which can include: [a]<br><br>   i) identifying the aspects of human-centred quality to be evaluated;<br><br>   ii) identifying defects that affect human-centred quality;<br><br>   iii) identifying recommendations for improving the human-centred quality of the object of evaluation;<br><br>   iv) identifying additional user requirements;<br><br>   v) obtaining a baseline for human-centred quality for the whole system, product or service;<br><br>   vi) comparing the human-centred quality of different systems, products or services;<br><br>   vii) reporting conformity with specified criteria.<br><br>2) Agree on the user group(s) to be considered for the evaluation (HCP.3.2.1). [c]<br><br>   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.<br><br>3) Select the context of use to be used for evaluation that adequately represents the real context of use. [c]<br><br>   NOTE 2 If tasks are used, then tasks are specified based on the users' intended objectives.<br><br>4) Agree appropriate methods for the inspection-based or user-based evaluation and the evaluation schedule. [b]<br><br>   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.<br><br>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]<br><br>6) Plan the involvement of stakeholders as appropriate. [d]<br><br>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 | 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.<br><br>b)  Identified issues are prioritized from a user perspective with proposed solutions.<br><br>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) | 1)  Conduct evaluation according to agreed-upon methods. [a]<br><br>2)  Carry out sufficiently comprehensive evaluation to provide meaningful results for the system as a whole. [a]<br><br>3)  Analyse the evaluation results, which can include the following: [a]<br><br>   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.<br><br>   ii)  defects that affect human-centred quality are identified;<br><br>   iii)  recommendations are made for improving the design of the object of evaluation to resolve defects that affect human-centred quality;<br><br>   iv)  failures to meet user requirements are identified;<br><br>   v)  overlooked and emergent user requirements are identified;<br><br>   vi)  incompleteness and misinterpretations in the user interaction specification and user interface specification are identified;<br><br>   vii)  quantitative information such as a base line is obtained for human-centred quality for the whole system, product or service;<br><br>   viii)  results that enable the human-centred quality of different systems, products or services to be compared.<br><br>4)  Prioritize any issues from a user perspective and propose solutions. [b]<br><br>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]<br><br>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 | a) The needs of the users and stakeholders related to introduction and adoption of the system are known by the project.<br><br>b) User requirements for enabling systems and services needed for implementation are identified and implemented.<br><br>c) The system can be adapted (as appropriate) to meet the requirements of individual implementations.<br><br>d) The system takes sufficient account of applicable legal requirements for use in the installation location.<br><br>e) The implementation plan addresses user and stakeholder needs.<br><br>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.<br><br>g) User help and training are provided and used when needed.<br><br>h) User support is provided.<br><br>i) A smooth transition to new job designs and/or teamwork arrangements is achieved.<br><br>j) First use problems are minimized.<br><br>k) Human-system issues identified when the system is first used are resolved.<br><br>l) The interactive system meets user requirements in the actual context of use. |
| Process activities (typical) | 1) Determine and communicate impact of introduction on users and stakeholders. [a]<br><br>2) Identify user requirements for any enabling systems or services required for implementation. [b]<br><br>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]<br><br>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]<br><br>5) Identify needs for customization/localization, training and documentation. [a, c]<br><br>6) Define communication to stakeholders, and actual/potential users. [a, f]<br><br>7) Develop and deliver help, instructions and training material. [g]<br><br>8) Develop and implement a user support system. [h]<br><br>9) Manage the changes required to introduce the system. [i]<br><br>10) Identify and monitor human-system issues when the system is first used. [k]<br><br>11) Identify differences between expected and actual context of use. [j, l]<br><br>12) Perform user-centred evaluation after introduction. [l]<br><br>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 | a) The context of use is monitored for changes.<br><br>b) User reactions and in-service data are analysed.<br><br>c) Emergent safety, health, environmental and quality issues are addressed.<br><br>d) The design of maintenance procedures takes account of user feedback and the impact on human-centred quality.<br><br>e) Maintenance addresses human-system issues.<br><br>f) Existing functions that are important to users are retained.<br><br>g) Maintenance does not adversely affect human-centred quality. |
| Process activities (typical) | 1) Systematically monitor the context of use of the operational system for changes. [a]<br><br>2) Investigate system use to collect and analyse user and stakeholder feedback for human-system and human-centred quality issues. [b]<br><br>3) Identify use-related human-system issues of the system including the extent to which user and maintainer support needs are being met. [b]<br><br>4) Systematically monitor adverse events to identify emergent health, safety, and environmental issues. [b, c]<br><br>5) Assess compliance with applicable health, safety, and environmental operational regulations. [c]<br><br>6) Resolve and document identified health, safety and environmental issues, and verify that solutions do not create additional issues. [c]<br><br>7) Identify user requirements for corrective and preventive maintenance strategies, enabling systems or services, as well as resources, needed for maintenance. [d]<br><br>8) Identify and address human-systems issues in maintenance and redesign, and ensure that resolutions do not negatively impact human-centred quality. [e]<br><br>9) Assess the potential impact of new technologies on usability/ maintainability/ increased human-centred quality. [a]<br><br>10) Assess the impact of changes on users including usability, accessibility, user experience and potential harm or benefits that can arise from use. [a]<br><br>11) Assess the impact of changes on training, help, user support and synchronisation across user platforms. [a]<br><br>12) Prioritize human-system issues. [g]<br><br>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 | a) User reactions and in-service data are used to define new versions of the system <br><br> b) User requirements for the revised system take actual use into account. <br><br> c) Existing functions that are important to users are retained. <br><br> d) Identified human-centred quality issues are accepted by supply organizations as objectives for improvement of future systems. <br><br> e) Upgrades and new versions do not adversely affect human-centred quality. <br><br> f) Decisions concerning upgrades and new versions take into account user feedback and the impact on human-centred quality. |
| Process activities (typical) | 1) Assess the potential impact of new technologies on usability/maintainability/ increased human-centred quality. [a] <br><br> 2) Identify use-related human-system issues of the existing system. [a] <br><br> 3) Investigate actual system usage. [b] <br><br> 4) Analyse user and stakeholder feedback for human-system and human-centred quality issues [b] <br><br> 5) Analyse health, safety, quality and environment issues. [b] <br><br> 6) Identify in what ways the requirements for the future system need to take account of how the existing system is used. [b] <br><br> 7) Develop a human-centred upgrade list. [c] <br><br> 8) Prioritize human-system issues. [c] <br><br> 9) Identify the existing user requirements that are to be retained for the future system. [c] <br><br> 10) Provide feedback to supply organizations about human-centred quality issues identified in operations so that future systems can be improved. [d] <br><br> 11) Assess the impact of changes on human-centred quality. [f] <br><br> 12) Assess the potential impact of upgrades on training, help, user support and synchronisation across user platforms [f] <br><br> 13) Modify the system to address human-system issues identified by evaluation in use. [f] |

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### 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 | a) User requirements for the new system take actual use into account.<br><br>b) Existing functions that are important to the user are retained.<br><br>c) User reactions and in-service data are used to define future versions of the system.<br><br>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.<br><br>e) User requirements for the replacement(s) of the system are identified<br><br>f) The health, safety, security, privacy, regulatory and environmental issues associated with removal from service and/or system disposal are identified and addressed.<br><br>g) Human-centred quality is maintained during transition to replacement systems.<br><br>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) | 1) Investigate actual system usage. [a]<br><br>2) Identify in what ways the requirements for the future system need to take account of how the existing system is used. [b, h]<br><br>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]<br><br>4) Identify whether there are any consequences for users related to loss of the system. [b, e, f, g, h]<br><br>5) Develop a plan for system retirement, disposal, and/or replacement. [g]<br><br>6) Conduct debriefing and retrospective analysis for a replacement system. [c, e]<br><br>7) Identify use-related human-system issues of the existing system. [c, g, h]<br><br>8) Collect and analyse in-service reports to generate updates or lessons learnt for the next version of the system. [c, g, h]<br><br>9) Define how users will be re-allocated, dismissed, transferred to other duties [d]<br><br>10) Communicate system end of life and potential alternatives to users. [d]<br><br>11) Plan break-up of social structures [d]<br><br>12) Identify risks including health and safety issues associated with removal from service and destruction of the system. [f]<br><br>13) Comply with all health, safety, regulatory and environmental regulations applicable to system destruction and/or disposal. [f] |

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