

TRUMP VERSION

Usability Maturity Model: Processes

J Earthy

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Abstract

A process model for human-centred activities in the system lifecycle based on ISO 13407, the British HCI Group ISM, the Philips HPI model and Eason and Harker's human system maturity model. The background to the model is described. The model describes seven processes each defined by a set of base practices. The base practices are defined. A set of work products are given for each process. A summary is provided of the ISO 15504 scale for the assessment of the maturity of processes. The uses of the model are outlined. A recording form is supplied and its use described. Mappings of the base practices to processes in SPICE, CMM and SE-CMM are provided. The process model is conformant to ISO 15504. This version is prepared for INTERACT'99.

Keywords: process assessment, software process improvement, ISO 15504, ISO 13407, human-centred, user-centred.

Executive summary

This document presents a model for, and explains the method by which to assess, the degree of capability reached by an organisation in its ability to perform human-centred design activities. The model is intended to be used in the assessment and improvement of the human-centred processes in system development. It is based on ISO 13407 'human-centred design processes for interactive systems'. It is designed for use by the following groups:

- human factors and human computer interaction advisors/consultants
- process assessors
- process improvement consultants
- developers of maturity models

The model provides a set of human-centred processes which can be used to extend existing software process models, such as ISO 12207 'Software lifecycle processes', the Capability Maturity Model (CMM) and ISO TR 15504 'Software process assessment'. Mappings to the main process assessment models are provided in Annexes to the document.

The human-centred development (HCD) processes in the model are as follows:

- HCD.1** Ensure HCD content in systems strategy
- HCD.2** Plan and manage the human-centred design process
- HCD.3** Specify the user and organisational requirements
- HCD.4** Understand and specify the context of use
- HCD.5** Produce design solutions
- HCD.6** Evaluate designs against requirements
- HCD.7** Introduce and operate the system

The model also describes six levels of capability in the performance of these practices:

- Level 0** Incomplete (not able to carry out process)
- Level 1** Performed (individuals carry out process)
- Level 2** Managed (quality, time and resource requirements for process known and controlled)
- Level 3** Established (process carried out as specified by organisation, resources are defined)
- Level 4** Predictable (performance of process within predicted resource and quality limits)
- Level 5** Optimising (organisation can reliably tailor process to particular requirements)

The following uses of the model are illustrated:

- process definition
- process improvement
- formal process assessment (1/ assessment of human-centred processes, 2/ use of human-centred processes with other models)
- informal assessment.

An assessment recording sheet and informative material for use by assessors are included in the document. The Usability Maturity Model conforms to ISO 15504.

Changes

0.1	First version	J Earthy	D514_a.doc, D514_b.doc
0.2	Second version	J Earthy	D514p_c.doc
1.0	Approved version	J Earthy	D514p_1.doc
1.1	Copyright version	J Earthy	D514p_1b.doc
2.0	TRUMP version	J Earthy	TR_UMP_a.doc
2.1	TRUMP version	J Earthy	TR_UMP_b.doc
2.2	INTERACT'99 version	J Earthy	TR_UMP_c.doc

Approval

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Author:

Jonathan Earthy, Lloyd's Register

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About this document

This document provides a model for, and explains the method by which to assess, the degree of capability reached by an organisation in its ability to perform human-centred design activities. Maturity in design performance is indicated via a Capability Scale of six levels applied in each of seven Human-Centred Development processes.

Scope

This document contains a model of human-centred processes. It is intended to be used in the assessment and improvement of the human-centred processes in system development. The model is based on ISO 13407 which has as its scope '*guidance on human-centred design activities throughout the life cycle of interactive computer-based systems. It is a tool for those managing design processes*'. This model extends that scope in the areas of new product development and human-system interface activities.

Overview

This section outlines the content of the document.

The Introduction explains why a human-centred approach is beneficial and how human-centredness relates to usability and ergonomics. It provides the background to the model presented and describes the elements of the model. The relationship of the model to ISO 15504 is described.

The Human-Centred Development Processes section is the core of the document. It starts with a description of the terms and format used in the model. The model itself consists of seven processes which may be enacted during the development of a system. Each process is described in terms of its goals and the sub-processes into which it can be decomposed. Annex 2 contains lists of work products which are used or produced by each process.

The 15504 Capability Scale describes six sets of process management activities which define levels of organisational maturity in the management of work. This scale can be used to assess the degree of maturity of the organisation in performing the processes described in the preceding section.

The Use of the Model is the final section of the main document. It contains guidance on the various uses which can be made of the model.

Annex 1 reviews the stakeholders in the model. Annex 2 lists the work products associated with each human-centred development process. Annexes 3-5 provide mappings of the processes in the usability maturity model to other process models. Annexes 6&7 provide advice and materials for assessors using the model. Annex 8 is a statement of conformance to ISO 15504. Annex 9 lists the contributors to the development of the model. Annex 10 records revisions to the document.

The human-centred process model is being developed as a Technical Report by ISO TC159/SC4/WG6. The process definitions and Work Products from that document are reproduced here under the terms of the waiver in that document. Readers are referred to ISO for the latest version of the model.

How to Use the Document

This section lists the recommended sequences for studying this document for each of the intended groups of readers:

- 1. Human Factors and Human Computer Interaction advisors/consultants.** These readers should study the Overview and the Introduction, taking special account of the process issues, which may be less familiar. The section on Human-Centred Development Processes should be familiar. The issues of measurement in the section Use of the Model should be studied. The 15504 Capability Scale will be less familiar and should be studied in detail. Reference should also be made to ISO TR 15504 Parts 2 and 5 for details of a standard capability scale which is often used to provide a rating of the organisation's capability in performing each process.¹
- 2. Process Assessors.** Elements of the model are likely to be integrated into an assessment tool by the lead assessor or a tool provider. Those unfamiliar with the 15504 standard for capability models should study the Overview and the later parts of the Introduction. Those unfamiliar with human-centred approaches should study the earlier parts of the Introduction, the Human-Centred Design Processes and the section Use of the Model. Study of ISO 13407 and some of the HF guides listed in the References section is also advised. The work product lists in Annex 2 and the mappings in Annexes 3 to 5 should assist lead assessors in selecting base practices to add to their standard set. Annex 6 may be of use to assessors inexperienced in assessing human-centred processes. For assessors who are not using an assessment tool the forms in Annex 7 may be of use.
- 3. Process Improvement Consultants.** These readers should study the Introduction in detail, taking special account of the earlier sections which describe the human-centred approach. The section Human-Centred Development Processes describes the lifecycle processes which should be put in place to make a project or organisation human-centred in the way it does things. Annex 2 lists the work products of human-centred processes.
- 4. Developers of Maturity Models.** The model follows ISO 15504, SPICE. Readers should study the overview and annexes 2 to 5 to see how the model is constructed. The early parts of the Introduction explain why the model has been constructed and what it contains. The section Human-Centred Development Processes contains the technical section of the model.

The rest of the stakeholders listed in Annex 1 are not expected to use this document. It is expected that suitable interpretations will be produced by the readers of this document for these stakeholders. Process models are intended for customisation. All readers are referred to the section Use of the Model where tailoring of the model

¹ A companion document, D5.1.4(s) *Usability Maturity Model: Human-Centredness Scale* may also be of use to HF consultants. This second document presents a scale against which an organisation's degree of human-centredness can be measured.

for use in a manner appropriate to the user or client organisation and the purpose for which the model is used is discussed.

Maintenance

This document is intended as a basis for good practice in human factors and human computer interaction work. It is being developed for the European Union, the European Usability Support Centres and the Human-Centred Process Improvement Group by Lloyd's Register. Comments, suggestions and other feedback on this document and its contents should be directed to Jonathan Earthy at Lloyd's Register at the following address:

29 Wellesley Road fax: +44 181 681 4870
Croydon tel: +44 181 681 4823
CRO 2AJ email: jonathan.earthy@lr.org
UK

Glossary of terms

assessment indicator An objective attribute or characteristic of a practice or work product that supports the evaluation of the performance of, or capability of, an implemented process.

base practice See practice.

CMM Capability Maturity Model, specifically the Carnegie Mellon University, Software Engineering Institute's Software Capability Maturity Model (Humphrey, 1989)

(process) **capability** The ability of a process to achieve a required goal.

(process) **capability level** A point on the six-point ordinal scale (of process capability) that represents the increasing capability of the performed process. Each level builds on the capability of the level below.

context of use The users, tasks, equipment (hardware, software and materials), and the physical and social environments in which a system is used.

ergonomics The study of human capabilities and limitations, human interaction with technologies and environments, and the application of this knowledge to products, processes and environments.

human/user-centred Approaches which have as their primary intention or focus the consideration of the interests or needs of the individuals and/or groups which will work with or use the output from a system.

lifecycle The development, operation and maintenance of a system, spanning the life of the system from the definition of its requirements to the termination of its use.

management practice A management activity or task that addresses the implementation or institutionalization of a specified process attribute.

practice A technical or management activity that contributes to the creation of the output (work products) of a process or enhances the capability of a process.

process A set of interrelated activities, which transform inputs into outputs. In this model nearly the equivalent of a CMM **key process area (KPA)**.

process assessment A disciplined evaluation of an organisation's software processes against a model.

process attribute A measurable aspect of a process related to its maturity.

process category A set of processes addressing the same general area of activity.

process capability determination A systematic assessment and analysis of selected software processes within an organisation against a target capability, carried out with the aim of identifying the strengths, weaknesses and risks associated with deploying the processes to meet a particular specified requirement.

process improvement Action taken to change an organisation's processes so that they meet the organisation's business needs and achieve its business goals more effectively.

product All goods or services including a product which is comprised in another product, whether by virtue of being a component part or the entire product.

prototype Refers to any artefact created for the purpose of demonstration to users in order to elicit or test user feedback. This includes *inter alia* demonstrators, mock-ups, paper prototypes, simulations, role-plays, dummy systems or documents, scenarios etc.

quality in use The effectiveness, efficiency and satisfaction with which specified users can achieve specified goals in specified environments.

stakeholder Any individual who is affected by the output from, provides the input to, develops, maintains, uses or manages the use of a system.

system In this document the term *system* is used to describe a *product (qv.)*, implemented in any combination of physical equipment, computer software, documentation, human tasks and organisational or management procedures. A *system* can range from an entire outsourced information provision service, to a worksystem, to a consumer item such as a lawnmower.

task An activity that a user of a system needs to do in order to achieve an objective.

task analysis The elicitation, representation and analysis of a set of tasks in order to understand, describe and/or improve the performance of work.

user Anyone who employs an artefact or system to achieve a task.

worksystem The work system comprises a combination of people and working equipment, acting together in the work process, to perform the work task, at the work space, in the work environment, under the conditions imposed by the work task.²

(associated) **work product** A document, piece of information, product or other item which acts as input to or output from a process.

² For definitions of the terms used in the definition of work system see ISO 6385-1981 'Ergonomic principles in the design of work systems'.

Introduction

Benefits of Human-Centredness in the Lifecycle

This document is intended to assist those who wish to make their system development process and its associated support processes more human-centred. It presents a definition of the processes which comprise a human-centred approach and lists their components, outcomes and the information used and produced.

ISO 13407, the standard for human-centred design processes for interactive systems, describes Human-centred development as *‘An approach to interactive system development that focuses specifically on making systems usable. It is a multi-disciplinary activity, which incorporates human factors and ergonomics knowledge and techniques. The application of human factors and ergonomics to interactive systems design enhances effectiveness and efficiency, improves human working conditions, and counteracts possible adverse effects of use on human health, safety and performance. Applying ergonomics to the design of systems involves taking account of human capabilities, skills, limitations and needs.’*

It goes on to say that *‘Human-centred systems empower users and motivate them to learn. The benefits can include increased productivity, enhanced quality of work, reductions in support and training costs and improved user health and safety. Although there is a substantial body of human factors and ergonomics knowledge about how such design processes can be organised and used effectively, much of this information is only well known by specialists in those fields. This International Standard aims to help those responsible for managing hardware and software design processes to identify and plan effective and timely human-centred design activities. It complements existing design approaches and methods.’*

Rationale for the Model

This model has been developed in response to a need to measure how well organisations do the human-centred part of system development and support projects. The model is also intended to provide a basis for those planning what human-centred activities to perform on a project and to assist those who wish to improve how well their organisations perform human-centred activities. The model has been developed as a stand-alone model, not as part of one of the existing process models, such as ISO 12207 ‘Software lifecycle processes’, the Capability Maturity Model (CMM) and the System Engineering Capability Maturity Model (SE-CMM) or ISO TR 15504 ‘Software Process Assessment’. This is mainly because of the number and variety of process models, but also to make more clear the nature of human-centred activities and their implications for system lifecycles. The model conforms to and extends ISO DIS 13407 Human-Centred Design Processes for Interactive Systems. This standard should be referred to for more guidance and advice on the reasons for a human-centred approach and purpose of human-centred activities. Mappings to the key system development models are provided in Annexes to this document.

Basis of the Model

This model uses the format common to process assessment models. These models clearly detail what **processes** ought to be done by an organisation to achieve defined technical goals. The processes in this model are described in the format defined in ISO 15504. The primary use of a process assessment model is for the measurement of how well an organisation carries out the processes covered by the model.

However, such models can also be used as a description of what is required in order to design and develop effective organisational and project processes.

How well an organisation carries out system development processes is measured on a **capability scale**. This is an ordered list of management activities. These activities are ranked according to how far they take the organisation towards the quality goals defined by Crosby (1978) and refined for software development by Humphrey (1989). The ISO 15504 capability scale is included in this version of the model. This scale is also used in the SE-CMM. The scale can be used as a basis for assessing how well the processes in the model are being performed, or as a model for the implementation of management and quality activities in a project or organisation.

Elements of the Model

The human-centred development process model consists of seven sets of base practices. These practices describe what has to be done in order to represent and include the users of a system during the lifecycle.

Figure 1 summarises the contents of the model as a process hierarchy.

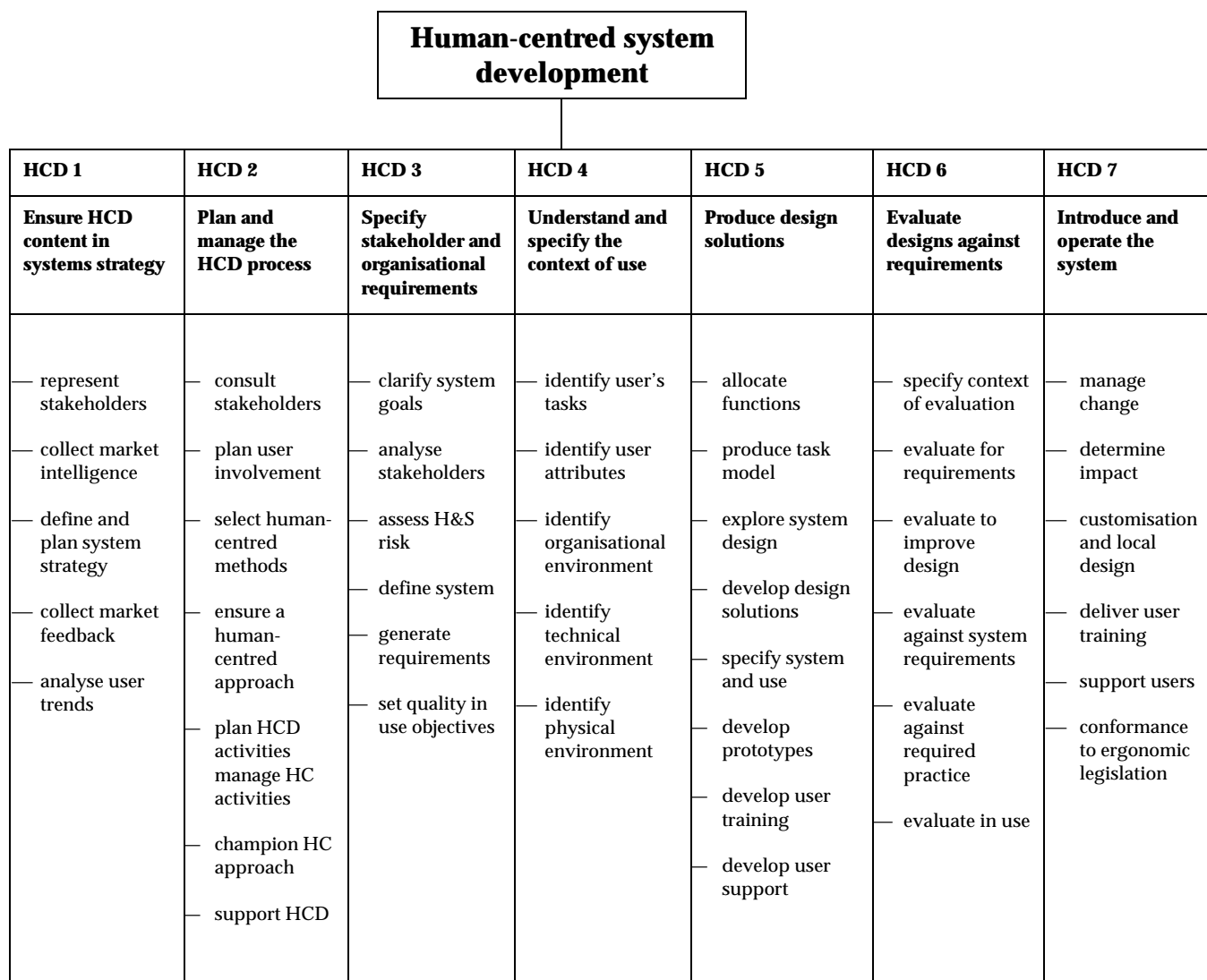


Figure 1. Human-centred design processes and their base practices

The processes in the model are linked and human-centred lifecycles are iterative.

Whilst it is possible to draw a number of simple diagrams which demonstrate the iterative nature of the human-centred lifecycle there are many different versions of lifecycles, depending on the type of system being developed and the market sector for which the system is intended. It is therefore difficult and may even be confusing to draw one simple diagram which demonstrates how processes are linked.

In general HCD 3-6 are more technical and form a tight loop at the core of the development. This loop will be cycled several times during a typical development. HCD 2 covers management and control. It uses information generated by the HCD 3-6 loop. HCD 2 connects the human-centred lifecycle to other processes in system development. HCD 1 connects the human-centred lifecycle to higher management processes and looks to the future of systems. HCD 1 also sets boundaries and goals for projects which then cycle through HCD 3-6 and are implemented with HCD 7.

HCD 7 is concerned with the use of the system. It connects the HCD processes to the support phase of the system lifecycle.

Structure of the Model

The following entity relationship diagram describes the formal components of the model presented in this document.

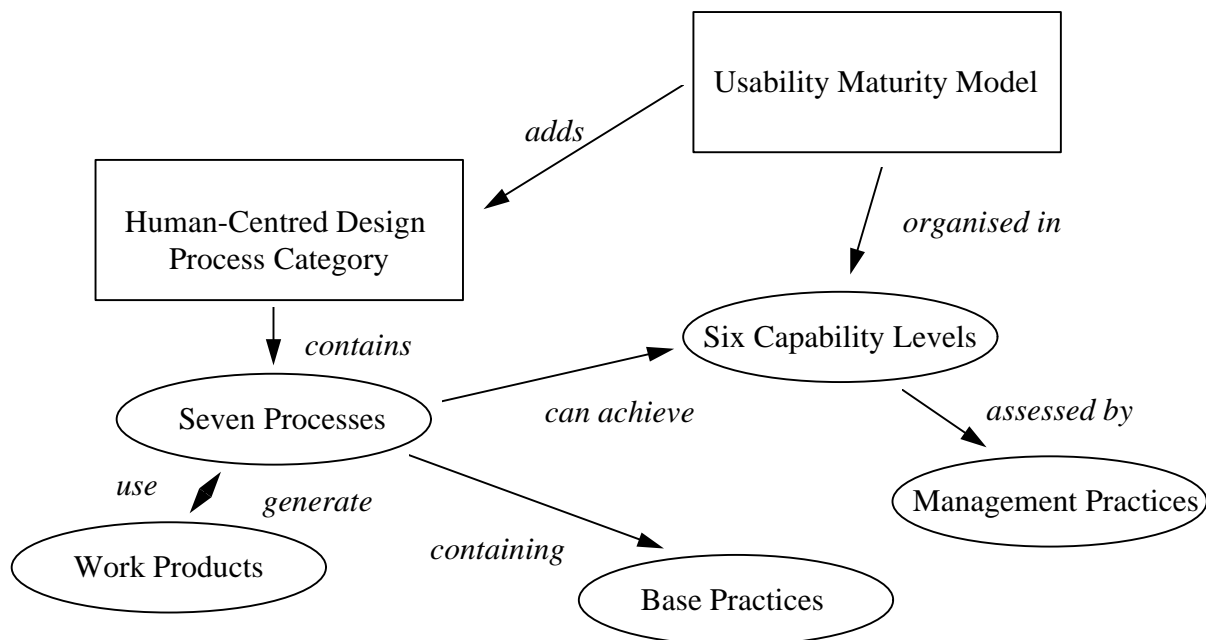


Figure 2. Entity relationship diagram of the model

ISO15504 Software Process Assessment

ISO TR 15504, presents a standard for software process capability determination. It defines a normative approach to the assessment of software process maturity. The processes presented in this document conform to ISO 15504 requirements for variant processes. A statement of conformance to ISO TR 15504 Part 2 is given in Annex 8.

Those familiar with process maturity models will note that this model differs from generic models in that some practices (particularly evaluation activities) are enacted at particular times in a lifecycle and there is a requirement for the lifecycle to have certain attributes, such as the ability to iterate (particularly during the design of the system). These requirements arise from the technical necessities of a lifecycle which takes account of user requirements. These can never be fully specified for a system throughout its entire life at the beginning of the development process. This pragmatic consideration breaks one of the requirements of pure capability models in which all processes and practices can be enacted independently and continuously. However, users will find that the model supports a considerable degree of freedom in selection and implementation of lifecycles and practices, even within the limitations of this pragmatic consideration.

Human-centred processes

Human-centred design

Human-centred design is achieved through the performance of **processes** which address the consideration of end-users and other stakeholders in the specification, development and operation of a system. These processes always relate to the whole system under development, not just the details of the software. The processes cover human-centred activities throughout the life of a system.

NOTE - The process descriptions describe two categories of roles for the people involved with interactive systems. Firstly the **end users** of the system. Secondly the **developers** and **maintainers** of the system. Most processes describe what the developers and maintainers should do to take account of the needs, context and capabilities of the end users. Some processes describe what the end users do when taking part in the development of the system. Readers should be aware of this necessary variability in focus of the process descriptions.

The human-centred design processes are presented in Figure 1 and are described in the following sections.

Processes are enacted through the implementation of a set of component **base practices**. Base practices are sub-processes of a process. They describe what needs to be done in order to achieve the process. Practices are enacted through the use of methods, techniques and tools. Particular human-centred methods, techniques and tools are not described in this model. However, some explanatory notes to the practices illustrate the requirements of methods, techniques and tools. Ergonomics standards and informative texts which describe how to carry out the base practices are available in the general literature and some are listed in the annexes and bibliography to ISO 13407 *Human-centred design processes for interactive systems*.

Processes use and produce **associated work products**. Associated work products can be in many forms, including the following: pieces of information, documents, hardware, software, training courses, awareness in individuals. Lists of typical associated work products from each of the processes described below are given in Annex A.

Ensure HCD content in systems strategy (HCD.1)

Purpose

The purpose of the process *Ensure HCD content in systems strategy* is to establish and maintain a focus on stakeholder and user issues in each part of the organisation which deal with system markets, concept, development and support. As a result of successful implementation of this process:

- marketing will take account of usability, ergonomics and socio-technical issues
- systems will be targeted to meet users' needs and expectations
- planners will consider stakeholder and organisation requirements in setting out systems strategy
- systems will be more responsive to changes in users (their needs, tasks, context, etc.)
- the enterprise will be more responsive to changes in its users

- systems are less likely to be rejected by the market.

NOTE - This process is not directly related to any clause in ISO 13407.

The purpose is typically achieved by the performance of the following processes.

Represent stakeholders (HCD.1.1)

Act as advocate for end users and other stakeholders in the system development enterprise and the development team.

NOTE - The stakeholder' advocate reminds the staff in the system development enterprise that the system is intended for use by real people and has to achieve quality in use. This role includes championing human-centred approaches, arranging for end-user involvement in conceptual studies, investigation and dissemination of context of use issues.

Collect market intelligence (HCD.1.2)

Perform foresight research into potential user groups in order to identify forthcoming needs for systems and new users or user organisations. Identify expected context of use of future systems. Set up procedures to elicit user input regarding future systems in their expected context.

Define and plan system strategy (HCD.1.3)

Present market information as a vision (e.g. for senior management approval). Operationalise vision into implementation strategy. Use lifecycle cost accounting in order to assess the cost of an HCD approach.

Collect market feedback (HCD.1.4)

Perform optimising research to refine and consolidate system strategy, based on feedback from users and non-users in the system's marketplace.

Analyse trends in users (HCD.1.5)

Look for changes in: users (e.g. their skills and training for user organisations, as well as needs and desires for consumer products), tasks (e.g. changes in type of work or volumes of work), context (e.g. changes in working and living environments, new technologies, social and political mores and expectations). Analyse this information to estimate future needs.

Plan and manage the HCD process (HCD.2)

Purpose

The purpose of the process *Plan and manage the human-centred design process* is to specify how the human-centred activities fit into the whole system lifecycle process and the enterprise. As a result of successful implementation of this process:

- the project plan will allow for iteration and incorporation of user feedback
- resources will be allocated for effective communication between the design team participants
- potential conflicts and trade-offs between human-centred and other issues will be reconciled
- human-centred processes will be incorporated into quality systems, procedures and standards
- human-centred issues will be supported and promoted within the organisation.

NOTE 1 - This process is directly related to ISO 13407, clauses: 7 *Planning the human-centred process*; 8.4.6 *Manage the Iteration of design solutions*; 8.5.2 *Evaluation plan*.

NOTE 2 - Some practices in this process overlap with the management practices in the ISO 15504 capability scale. This overlap also occurs in ISO 15504 itself, see Part 5 of that standard.

The purpose is typically achieved by the performance of the following processes.

Consult stakeholders (HCD.2.1)

Establish structures, mechanisms and procedures to ensure that relevant stakeholders are effectively involved and consulted in each significant aspect of the system development and implementation.

NOTE - Stakeholders include all types of users and anyone else affected by the system.

Identify and plan user involvement (HCD.2.2)

Decide on the most effective way to elicit user input at each stage of the project, taking best advantage of established good practice in team work and appropriate user involvement.

Select human-centred methods and techniques (HCD.2.3)

Decide which methods will be included and how they will link together in the development process. Define how this will interface to the particular lifecycle methodology being used in the development of the system.

Ensure a human-centred approach within the project team (HCD.2.4)

Establish a multi-disciplinary culture in the project team. Maintain staff focus on a human-centred approach. Identify the specialist skills required and plan how to provide them.

NOTE - A multi-disciplinary team provides the wide range of skills and viewpoints required to produce an operable system. Examples of the range of skills which may be required include: end user, purchaser, business analyst, marketer, visual designer, ergonomist, domain expert, technical author, human resources, health and safety, systems analyst, programmer.

Plan human-centred design activities (HCD.2.5)

Develop a plan specifying how the human-centred activities integrate into the overall system development process.

NOTE - A human-centred design plan specifies how input from human-centred design processes (based, for example, on those given in this document) is used in the design and development process. A human-centred design plan allows for iteration where necessary. A human-centred design plan includes long term monitoring of the use of the system. (see HCD.6.6)

Manage human-centred activities (HCD.2.6)

Take specific account of user issues in management of projects and development departments. Ensure that the system development process takes account of user input. Take account of stakeholder and user issues in support activities (e.g. contracts management and purchasing).

Champion human-centred approach (HCD.2.7)

Promote a human-centred approach within the enterprise. Establish and communicate a policy for human-centredness within the enterprise.

Provide support for human-centred design (HCD.2.8)

Include human-centred elements in support procedures (e.g. quality assurance, change control, process and method maintenance, resource management). Ensure that these are carried out as an integral part of the infrastructure management for the enterprise.

Specify the stakeholder and organisational requirements (HCD.3)**Purpose**

The purpose of the process *Specify the stakeholder and organisational requirements* is to establish the requirements of the organisation and other interested parties for the system. This process takes full account of the needs, competencies and working environment of each relevant stakeholder in the system. As a result of successful implementation of the process, the following will be defined:

- required performance of new system against operational and functional objectives
- relevant statutory or legislative requirements
- co-operation and communication between users and other relevant parties
- the users' jobs (including the allocation of tasks, users' comfort, safety, health and motivation)
- task performance of the user with the system
- work design, and organisational practices and structure
- feasibility of operation and maintenance
- objectives for the operation and/or use of the software and hardware components of the system.

NOTE 1 - This process is directly related to ISO 13407 clause 8.3 *Specify user and organisational requirements*.

NOTE 2 - HCD.3.1 to 3.3 determine high-level requirements for the system. HCD 3.4-3.6 define detailed requirements for the system. The definition of detailed requirements requires an understanding of the context of use. This is defined in HCD 4. The two processes therefore overlap in the lifecycle.

NOTE 3 - Stakeholders include all types of users and anyone else affected by the system.

The purpose is typically achieved by the performance of the following processes.

Clarify and document system goals (HCD.3.1)

Describe the objectives which the user or user organisation wants to achieve through use of the system.

NOTE- For a generic product the only user may be the end user of the system. For a larger or more complex system there will be more stakeholders and a user organisation.

Analyse stakeholders (HCD.3.2)

Identify and analyse the roles of each group of stakeholders likely to be affected by a system. Assess the significance and relevance of the system to each stakeholder group which will be end users of the system and/or will be affected by input to or output from the system.

Assess risk to stakeholders (HCD.3.3)

Review the safety, health and well-being risks to the stakeholders of the system. Relate this to the overall risk assessment for the system.

Define the use of the system (HCD.3.4)

Set and agree the required behaviour and performance of the system in terms of the total experience of the relevant stakeholders and/or the user organisation with the system. The total experience covers each aspect of a relevant stakeholder's relationship with the system from its commissioning to its de-commissioning.

Generate the stakeholder and organisational requirements (HCD.3.5)

Develop an explicit statement of the stakeholder and organisational requirements for the system.

NOTE 1 - The generation of requirements is a interactive and often iterative process.

NOTE 2 - Requirements may be ranked in order of importance.

NOTE 3 - Statutory requirements regarding working environment and workload are taken into account.

NOTE 4 - Stakeholder and organisational requirements define a large part of the operational and performance requirements for the system.

Set quality in use objectives (HCD.3.6)

Generate and agree on measurable criteria for the required quality in use of the system.

NOTE - The quality in use is stated as required levels of user effectiveness, productivity and satisfaction for the system or its component parts in the context of particular tasks based on performance requirements. (ISO/IEC 14598-1:1998, *Information Technology - Software Product Evaluation - Part 1: General Overview*)

Understand and specify the context of use (HCD.4)

The purpose of the process *Understand and specify the context of use* is to identify, clarify and record the characteristics of the stakeholders, their tasks and the organisational and physical environment in which the system will operate. As a result of successful implementation of this process the following will be achieved:

- definition of the characteristics of the intended users
- definition of the tasks the users are to perform
- definition of the organisation and environment in which the system is used
- the context of use is available and used at all relevant points in the lifecycle.

NOTE- This process is directly related to ISO 13407 clause 8.2 *Understand and specify the context of use*.

The purpose is typically achieved by the performance of the following processes.

Identify and document user's tasks (HCD.4.1)

Describe the activities which users perform to achieve system goals.

NOTE 1 - Tasks are described in terms of user and organisational activities, not solely in terms of equipment functions or features.

NOTE 2 - Tasks may change (or evolve) during the lifecycle of the system.

Identify and document significant user attributes (HCD.4.2)

Describe the relevant characteristics of the end-users of the system. This will include knowledge, language, physical capabilities, level of experience with job tasks and with relevant systems equipment etc..

Identify and document organisational environment (HCD.4.3)

Describe the relevant social and organisational milieu, management structure and organisational practices, etc.

Identify and document technical environment (HCD.4.4)

Describe the relevant characteristics of any equipment to be used. Particular attention should be paid to the equipment with which the users will directly interact.

NOTE - For new systems the equipment characteristics are dependent on the system design solutions (see HCD 5.4 and 5.5) and will not be known until relatively late in the lifecycle.

Identify and document physical environment (HCD.4.5)

Describe the location, workplace equipment and ambient conditions. For example, lighting, noise levels, vibration etc.

Produce design solutions (HCD.5)**Purpose**

The purpose of the process *Produce design solutions* is to create potential design solutions by drawing on established state-of-the-art practice, the experience and knowledge of the participants and the results of the context of use analysis. As a result of successful implementation of the process:

- the whole socio-technical system in which any technical components operate will be considered in the design
- user characteristics and needs will be taken into account in the purchasing of system components
- user characteristics and needs will be taken into account in the design of the system
- existing knowledge of best practice from socio-technical systems engineering, ergonomics, psychology, cognitive science and other relevant disciplines will be integrated into the system
- communication between stakeholders in the system will be improved because the design decisions will be more explicit
- the development team will be able to explore several design concepts before they settle on one
- feedback from end users and other stakeholders will be incorporated in the design early in the development process
- it will be possible to evaluate several iterations of a design and alternative designs
- the interface between the user and the software, hardware and organisational components of the system will be designed
- user training and support will be developed.

NOTE - This process is directly related to ISO 13407 clause 8.4 *Produce design solutions*.

The purpose is typically achieved by the performance of the following processes.

Allocate functions (HCD.5.1)

Analyse the context of use and the required functions and performance of the system, to distribute functions between the human, machine and organisational components of the system best able to fulfil each function.

NOTE 1 - The allocation of functions may be dynamic. The aim is to optimise the performance of the overall system against the system goals.

NOTE 2 - At high levels in the system hierarchy functions may not be allocated to particular human, organisational, software or hardware components but to sub-systems which may be made up from more than one of these components.

NOTE 3 - For function allocation the task analysis (HCD 4.1) is the most important component of the context of use.

Produce composite task model (HCD.5.2)

Develop a feasible model of the user's new tasks from existing knowledge of best practice, the requirements, context of use, allocation of function and design constraints for the system.

NOTE - HCD.5.1 to HCD.5.3 are enacted at each level in the system hierarchy. HCD.5.4 to 5.8 are enacted at the level where system components are being defined and developed.

Explore system design (HCD.5.3)

Generate and analyse a range of design options for each aspect of the system related to its use and its effect on stakeholders.

Use existing knowledge to develop design solutions (HCD.5.4)

Apply relevant human science information to the design of the system. Include the stakeholder and organisational requirements, context of use, international standards, legislative requirements, existing patents, good practice, style guides and project standards etc. in the design.

Specify system and use (HCD.5.5)

Produce a design for the user-related components of the system. Produce description(s) of how the system will be used. Change design in the light of feedback from evaluations.

NOTE - Depending on the type of system, the specification can include, but is not limited to, one or all of the following: design of users jobs, users tasks, working environment, hardware, software, user documentation, packaging design, interface functionality etc.

Develop prototypes (HCD.5.6)

Make design solution(s) more concrete using simulations, models, mock-ups etc. Develop simulation or trial implementation of key aspects of the system for the purposes of testing with users or user representatives.

Develop user training (HCD.5.7)

Identify, specify and produce the training required to enable relevant users to perform tasks effectively using the new system. Cover or include any proposed changes in business processes, job design and tasks.

Develop user support (HCD.5.8)

Identify, specify and produce the user support services for the system. Take into account the proposed changes in business processes and job design.

Evaluate designs against requirements (HCD.6)

Purpose

The purpose of the process *Evaluate designs against requirements* is to collect feedback on the developing design. This feedback will be collected from end users and other representative sources. As a result of successful implementation of this process:

- feedback will be provided to improve the design
- there will be an assessment of whether stakeholder and organisational objectives have been achieved or not
- long-term use of the system will be monitored.

In the case of evaluation to identify improvements to the system (**formative evaluation**), successful implementation of the process will reflect:

- potential problems and scope for improvements in: the technology, supporting material, organisational or physical environment and the training
- which design option best fits the functional and stakeholder and organisational requirements
- feedback and further requirements from the users.

NOTE 1 - Formative evaluation is generally carried out using fairly informal, open-ended, collaborative techniques (e.g. paper prototyping, discussion-based reviews etc.) early in the lifecycle in order to provide information for the requirements and design process. Summative evaluation is generally carried out as a validation activity using more formal, closed methods (e.g. assessment against product standards).

In the case of evaluation to assess whether objectives have been met (**summative evaluation**), successful implementation of the process will demonstrate:

- how well the system meets its organisational goals
- that a particular design meets the human-centred requirements
- conformity to international, national and/or statutory requirements.

NOTE 2 - This process is directly related to ISO 13407 clause 8.4 *Evaluate designs against requirements*.

NOTE 3 - Evaluation may be carried out in the short term (e.g. trials by potential users during design in order to compare features of prototypes) or in the long term (e.g. a post-installation study to validate the specification, monitoring of sickness records for health and safety problems or a survey to identify the requirements for the next version of a system).

NOTE 4 - The opportunities for end user involvement are investigated for each evaluation. If end users are not involved the risks are assessed.

The purpose is typically achieved by the performance of the following processes.

Specify and validate context of evaluation (HCD.6.1)

Describe and verify the conditions under which a system is tested or otherwise evaluated. Describe the relationship, and especially discrepancies, between the context of evaluation and the context of use.

NOTE - This practice is performed prior to each of HCD 6.2 to 6.6.

Evaluate early prototypes in order to define the requirements for the system (HCD.6.2)

Benchmark appropriate systems using relevant criteria. Test the usability of competing/alternative systems and/or system concepts. Use prototypes to stimulate stakeholder input to system requirements. Test stability of requirements.

Evaluate prototypes in order to improve the design (HCD.6.3)

Collect user input on the quality in use of the developing system. Present the results to the design team(s) in the most appropriate format.

Evaluate the system in order to check that the stakeholder and organisational requirements have been met (HCD.6.4)

Test the developing or final system to ensure that it meets the requirements of the users, the tasks and the environment, as defined in its specification. (see also HCD 3.5 and 3.6)

Evaluate the system in order to check that the required practice has been followed (HCD.6.5)

Check systems for adherence to applicable human science knowledge, style guides, standards, guidelines, and legislation.

Evaluate the system in use in order to ensure that it continues to meet organisational and user needs (HCD.6.6)

Check the system in use for changes in organisational, user, other stakeholder, and usability needs and to ensure that it continues to meet these needs. (see also HCD 3.5 and 3.6)

NOTE 1 - This includes routine contact with a representative number of users using a defined procedure to elicit information about human-centred aspects of the system by means of questionnaires, reports, logs, interviews etc. This also includes feedback to stakeholders.

NOTE 2 - Evaluation of the system in use can also be used to assess whether the requirements and the resulting specification were correct.

Introduce and operate the system (HCD.7)**Purpose**

The purpose of the process *Introduction and operate the system* is to establish the human-system aspects of the support and implementation of the system. As a result of successful implementation of this process:

- the needs of the stakeholders of the system will be communicated to the project
- the management of change, including the responsibilities of users and developers, will be specified
- the support requirements of end-users, maintainers and other stakeholders will be addressed
- there will be compliance to health and safety procedures
- local customisation of the system will be supported
- user reactions will be collected and the resulting changes to the system reported back to stakeholders.

NOTE 1 - This process is not directly related to any clause in ISO 13407 and may not be applicable to generic product development.

NOTE 2 - This process deals with the various HCD activities concerned with the operation of the system and may be enacted in part by the enterprise developing the system and in part by the organisation which operates the system.

NOTE 3 - The activities in this process have less in common with each other than the activities in the other HCDs. However, it is convenient to group them into one separate process.

NOTE 4 - HCD.6.6 describes an important aspect of monitoring of the system in operation. However, because it is also enacted at start-up and may be carried out to elicit re-design information it is described in HCD.6.

NOTE 5 - The context of use may change during the life of a system. Periodic re-assessment may be required. This process comprises the following practices.

The purpose is typically achieved by the performance of the following processes.

Management of change (HCD.7.1)

Facilitate, oversee and ensure the HCD aspects of system implementation.

NOTE - This includes re-organisation of job design and working practices, group/teamwork, training, new business processes, reporting responsibilities etc.

Determine impact on organisation and stakeholders (HCD.7.2)

Assess the human and organisational impact of the system to be introduced.

Customisation and local design (HCD.7.3)

Provide support for customisation of the system to meet local cultural or operational needs. Provide support for customisation and configuration to meet the needs of specific users. Provide details of customisation to configuration management.

Deliver user training (HCD.7.4)

Deliver training and workshops to users to meet identified training needs and facilitate the transition to new designs of jobs and new teamworking arrangements.

Support users in planned activities (HCD.7.5)

Maintain contact with users and the client organisation throughout the definition, development and introduction of a system.

Ensure conformance to workplace ergonomic legislation (HCD.7.6)

Survey of workplaces, users and training programmes to ensure that the software, hardware and workplace meet the requirements of national legislation. (see also HCD.6.5)

The ISO 15504 Capability Scale

This section presents an overview of the ISO 15504 model for the management and organisational quality activities which should be carried out when enacting any technical process, including those given in the preceding section. The model has six levels of capability:

Level 0	Incomplete
Level 1	Performed
Level 2	Managed
Level 3	Established
Level 4	Predictable
Level 5	Optimising

At level 0, the organisation is not able to carry out the process. At level 1, individuals carry out processes. At level 2, the quality, time and resource requirements for the process are known and controlled. At level 3, the process is carried out in a manner specified by the organisation and the resources are defined. At level 4, the performance of the process is within predicted resource and quality limits. At level 5, the organisation can reliably tailor the process to particular requirements.

The following sections describe the *process definition attributes* of the processes described in the preceding section when they are performed to each of these levels of capability. The process definition attributes are cumulative. At each level the process exhibits more associated *management practices*. The performance of management practices give staff, management and organisation the necessary degree of control over the development process. The following sections are paraphrased from Part 5 of ISO 15504. The reader is referred to that document for more details of the capability scale and to the annexes of that document for lists of attribute indicators. Attribute indicators are:

- characteristics of the performance of a management practice which provide evidence of the implementation of the practice
- elements of the resource and infrastructure which support the management of the process
- associated processes from the ISO 15504 process dimension that support the management practice.

They are intended to help to establish objective evidence that the management practices associated with the process attribute are being performed. In UMM assessment some HCD 2 practices may also provide evidence of the performance of management practices.

Level 0: Incomplete process

The process is not implemented, or fails to achieve its purpose. There are no attributes at this level.

Level 1: Performed process

The implemented process achieves its defined purpose.

The following attributes of the process demonstrate the achievement of this level:

Process performance attribute (PA1.1)

The degree to which output work products are produced from input work products through enactment of the practices which comprise the process.

The related management practice to achieve this process attribute is:

MP1.1.1 Ensure that base practices are performed to satisfy the purpose of the process.

Level 2: Managed process

The Performed process delivers work products of acceptable quality within defined timescales and resource needs.

The following attributes of the process demonstrate the achievement of this level:

Performance management attribute (PA2.1)

The degree to which the process is managed to produce work products within stated time and resource requirements.

The related management practices are:

MP2.1.1 Identify resource requirements to enable planning and tracking of the process.

MP2.1.2 Plan the performance of the process by identifying the activities of the process and the allocated resources according to the requirements.

MP2.1.3 Implement the defined activities to achieve the purpose of the process.

MP2.1.4 Manage the execution of the activities to produce the work products within stated time and resource requirements.

Work product management attribute (PA2.2)

The degree to which work products are documented and controlled to meet their functional and non-functional requirements.

The related management practices are:

MP2.2.1 Identify requirements for the integrity and quality of the work products.

MP2.2.2 Identify the activities needed to achieve the integrity and quality requirements for work products.

MP2.2.3 Manage the configuration of work products to ensure their integrity.

MP2.2.4 Manage the quality of work products to ensure that the work products meet their functional and non-functional requirements.

Level 3: Established process

The Managed process ensures the deployment of a defined process based upon good system engineering principles.

The following attributes of the process demonstrate the achievement of this level:

Process definition attribute (PA3.1)

The degree to which the process contributes to the defined business goals of the organisation through definition of a standard process.

The related management practices are:

MP3.1.1 Identify the standard process definition from those available in the organisation that is appropriate to the process purpose and the business goals of the organisation.

MP3.1.2 Tailor the standard process to obtain a defined process appropriated to the process context.

MP3.1.3 Implement the defined process to achieve the process purpose consistently, and repeatably, and support the defined business goal of the organisation.

MP3.1.4 Provide feedback into the standard process from experience of using the defined process.

Process resource attribute (PA3.2)

The degree to which the process contributes effectively to the defined business goals of the organisation through use of suitable, skilled human resources and process infrastructure.

The related management practices are:

MP3.2.1 Define the human resource competencies required to support the implementation of the defined process.

MP3.2.2 Define process infrastructure requirements to support the implementation of the defined process.

MP3.2.3 Provide adequate skilled human resources meeting the defined competencies.

MP3.2.4 Provide adequate process infrastructure according to the defined needs of the process.

Level 4: Predictable process

The Established process is performed consistently within defined control limits to achieve its goals.

The following attributes of the process demonstrate the achievement of this level:

Process measurement attribute (PA4.1)

The degree to which goals and measures are used to ensure that implementation of the process contributes to the achievement of the goals.

The related management practices are:

MP4.1.1 Define process goals and associated measures that support the business goals of the organisation.

MP4.1.2 Provide adequate resources and infrastructure for data collection.

MP4.1.3 Collect the specified measurement data from the implementation of the defined process.

MP4.1.4 Evaluate achievement of process goals by comparison of recorded measures.

Process control attribute (PA4.2)

The degree to which reliable achievement of the defined process goals is achieved through collection and analysis of measures to control and correct the performance of the process.

The related management practices are:

MP4.2.1 Identify analysis and control techniques appropriate to the process context.

MP4.2.2 Provide adequate resources and infrastructure for analysis and process control.

MP4.2.3 Analyse available measures to identify process control parameters.

MP4.2.4 Identify deviations and take required control actions to maintain control of the process.

Level 5: Optimising process

The Predictable process adapts its performance to meet current and future business needs and meets its defined business goals reliably.

The following attributes of the process demonstrate the achievement of this level:

Process change attribute (PA5.1)

The degree to which the business goals of the organisation are achieved through changes in the definition, management and performance of the process.

The related management practices are:

MP5.1.1 Identify and approve changes to the standard process definition on the basis of quantitative understanding of the process.

MP5.1.2 Provide adequate resources to effectively implement the approved changes in affected tailored processes.

MP5.1.3 Implement the approved changes to the affected tailored processes to achieve the expected outcome.

PM5.1.4 Validate the effectiveness of process change on the basis of actual performance against the process and business goals.

Continuous improvement attribute (PA5.2)

The degree to which continuous improvement in the fulfilment of the defined business goals of the organisation is ensured through changes to the process.

The related management practices are:

MP5.2.1 Identify improvement opportunities in a systematic and pro-active manner to continuously improve the process.

MP5.2.2 Establish an implementation strategy based upon the identified opportunities to improve process performance according to business goals.

MP5.2.3 Implement changes to selected areas of the tailored process according to the implementation strategy.

MP5.2.4 Validate the effectiveness of process change on the basis of actual performance against process and business goals and feedback to the standard process definition.

Use of the Model

Use of the model in process definition

The human-centred process model describes a complete set of the processes and sub-processes which are required to make systems human-centred. This makes it a useful resource for organisations, departments or projects designing a system development and/or support lifecycle which needs to be human-centred.

The recommended approach is for the organisation, department or project to set up a process to define their needs for such a lifecycle. The outcomes of the processes in this model (and other models) should be compared with the needs for this lifecycle. The UMM can be used as input at this stage. The first section of each of the seven HCD process descriptions lists the outcomes of the process.

The next step is to define a lifecycle which implements and integrates the base and management practices to the required level to achieve the business purposes of the organisation, department or project. The lists of work products in Annex 2 should assist in this definition. It should be noted that in some cases the practices described in HCD 7 will be performed by the purchaser, not the supplier, of the system.

More detailed information on most of the base practices is provided in ISO 13407, the ERGO guide (Dzida et al 1993), the UserFIT Guide (Poulsen et al 1996), the RESPECT handbook (Maguire, 1997) and the INUSE Guides (INUSE 1997). Advice on the particular methods which implement the practices is available from textbooks and human factors service providers, such as the European Usability Support Centres.

Use of the model in process improvement

The human-centred processes, the base practices and the work products provide a description of how organisations carry out activities which take account of user issues. The ISO 15504 Capability Scale 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 human-centredness 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 organisation with respect to its human-centredness. Sommerville and Sawyer (1997) give a simple introduction to process improvement for the system development lifecycle. Readers may also find a companion document to the UMM (Usability Maturity Model: Human-Centredness Scale, INUSE 1998) useful in defining management and organisational improvement actions.

Use of the model in formal process assessment

Human-Centred Processes

The model presented in this document can be used in the assessment of an organisation's capability to carry out the human-centred processes described in the

model. The intended assessment process is that defined in ISO 15504. The reader is referred to ISO 15504 for details of the qualification of assessors, quality processes associated with assessments etc.

The first step is the tailoring of the model for the assessment. This consists of selection of relevant processes and definition of the maximum capability which is likely to be observed. The processes selected should be representative of the activities carried out by the organisation. The model is not sacrosanct and should be tailored as much as necessary. The purpose of assessment is usually to gain a clear picture of the processes in a particular organisation for the purpose of process improvement. The benefit to the organisation is only realised if the model is tailored to suite the purposes of the assessee (Zultner, 1993, Fayad and Laitinen, 1997). Processes and practices should be selected for assessment if the organisation wishes to know how well that particular activity 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 which it considers necessary are performed to the level it requires. In this case the processes to be covered are defined by the client organisation.

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

The assessment itself is achieved by interviewing selected staff. Firstly, to ascertain how many of the base practices are performed for each process. Secondly, to ascertain how well these processes are implemented in terms of the performance of the management practices outlined in the preceding section, ISO 15504 Capability Scale. Annex 2 provides lists of work products which should be requested as evidence of the performance of the base practices. Hints on interview and assessment practice are given in Annex 6.

The interviewees should prepare for the assessment. They need to understand the model and why the assessment is being carried out. Some familiarity with process thinking is required. Interviewees should be able to provide evidence of the performance of practices, probably in the form of the work products described in Annex 2. ISO 13407 provides guidance on the provision of evidence for assessment of HF processes.

The assessee organisation 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 organisation's processes and practices map onto the UMM.

In general, interviews with a project manager and two or three members of project staff (the staff may be interviewed together) will be sufficient to give a reasonable impression of the level of maturity of a project.

In order to encourage openness and co-operation the assessment of whether practices are performed or not should be reasonably informal. It is best to ask the interviewee to describe how the process is carried out and only if the description is unclear to ask specific questions about particular practices or deliverables. At the

end of the discussion summarise the findings back to the interviewee in terms of what is and is not done and/or delivered. During the assessment of Capability it is advisable to start by getting the interviewee to describe how the process is managed, move on to asking specific questions about the lowest levels of maturity and move up the scale until it is obvious that the practices are not being achieved. It is not beneficial to go beyond this level. If interviewees are not well prepared or if time is short the assessor may resort to asking direct questions.

The form provided in Annex 7 may be used to record findings. Rate each practice for each interviewee on a scale of N to F where:

N	Not achieved:	There is no evidence of achievement of the defined practice.
P	Partially achieved:	There is some achievement of the defined practice.
L	Largely achieved:	There is significant achievement of the defined practice.
F	Fully achieved:	There is full achievement of the defined practice.

Give the benefit of the doubt when allocating ratings.

Use the form to calculate the rating of each process in the organisation with regard to performance of human-centred activities. The result of the assessment will form the basis of plans to review and/or improve human-centred processes within the organisation. There are no good or bad results from an assessment. The level of capability only needs to be good enough to allow the business to fulfil its objectives. The required profile of maturity (capability against process) will be defined by the client as part of process improvement.

Human-Centred Processes plus Other Models

The human-centred processes presented in this model may be used to augment the set of processes in other process models. This augmentation is likely to be carried out when a capability assessment is being performed on an organisation or department which develops or supports systems that gain business benefit from meeting the needs of their users. The mapping tables in Annex 3-5 show where the human-centred processes fit into some of the more common process maturity models.

The human-centred processes should be selected as part of the routine tailoring process which is carried out prior to an assessment. 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. HCD 2-6 are likely to be required in most assessments. HCD1 is more relevant to generic system development (such as domestic products) and HCD 7 is more relevant to large systems (such as public sector information systems). HCD 2,3 & 4 may be more relevant early in the lifecycle of a system but it should be noted that some of the practices in HCD 5&6 are required very early in the development of a system. The iterative nature of the human-centred lifecycle also means that elements of HCD 3&4 are still enacted during the support of a system.

Use of the model in informal assessment

The assessment approach described above is rigorous and is intended to give reproducible results across a variety of organisations. In some cases this degree of rigour and the associated formality are not appropriate.

The model can also be used 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 need not be introduced or, if it is, the assessment as to whether attributes are performed or not would become a group decision. The result need not be recorded, but a general agreement should be 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 may well be more valuable than recommendations given by improvement experts. Even where assessment is carried out by external assessors an element of group discussion can be built in in order to promote awareness and organisational learning. In informal assessment a group may 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.

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Annex 1: Impact on Stakeholders

Those affected by the model or its use are likely to come from one of the following stakeholder groups:

1. **Human Factors and Human Computer Interaction Advisors/Consultants.** This group requires a reference model for the activities which make up human-centred development. They will be familiar with human-centred issues but not so familiar with process improvement.
2. **Process Assessors.** This group requires a rigorous model to support measurement of maturity. They will be very familiar with process modelling and assessment but are unlikely to be familiar with human-centred approaches. They will be looking for practices (and maybe processes) to incorporate into existing tools when there is a need to assess human-centred processes.
3. **Process Improvement Consultants.** This group requires an explanatory model to support the development of human-centredness in projects and organisations. They will be familiar with process modelling but not necessarily familiar with human-centred approaches. Integration issues will be of interest.
4. **Business process engineers** who wish to take account of human-centred design issues in the products or services from a client organisation. This group may be unfamiliar with the level of detail in process models. A high didactic element will be required and benefits will be paramount.
5. **Developers of maturity models.** This group will be looking to take account of human-centred practices in system or software models. They will use this model as a source of modules which can be extracted and combined into assessment tools and/or other models. Purity and conformance to standard structures are their main requirements of this model.

Other groups will be affected by the use of the model. The needs of these groups should be taken into account by the users of this document:

1. **Staff involved in the projects which are assessed against the model.** In organisations with lower levels of human-centredness the issues being examined will be unfamiliar. There will be a high didactic element in the briefing for assessments. They will need a thorough and sympathetic presentation of the meaning of the results of assessments.
2. **Managers of projects which are assessed against the model.** The issues are similar to those for staff. This group should be involved in the preparation for assessments and will probably bear the brunt of the questioning during assessment interviews. In most cases the problem of interfaces between the project and specialist activities, human factors in this case, will be an important concern.
3. **Managers and staff of departments and/or projects which are the subject of human-centred process improvement exercises.** As for the two previous categories the needs of this group will depend on the level of human-centredness of the organisation. More mature organisations will find the model natural and

will probably concentrate on refining their higher management practices and capability improvement of human-centred processes.

Annex 2: Associated work products from HCD processes

The following sections list work products which are used by and which originate from HCD processes. Many of these products are elaborated or revised by subsequent processes. Because of the iterative nature of the human-centred lifecycle work products may be revised several times.

Table 1 - Ensure HCD content in system strategy (HCD.1)

Input	Output
Company strategy	System/product vision
Market surveys	Original specification
Technology forecasts	Social and socio-technical demands in target groups
Demographic studies	Predicted context(s) of use
Expert forecasts	Market appraisals
HCD strategy methodologies	Trend analysis
	System accounting process
	Human-centred system strategy

Table 2 - Plan and manage the HCD process (HCD.2)

Input	Output
Business plan	List of human centred activities to be carried out
Organisational resources	Procedure for integrating human centred activities with other development activities
Results of reviews	The individuals and organisation(s) responsible for the human-centred design activities and the range of skills and viewpoints they provide
Development plans for system	Procedures for establishing communication on human-centred design activities as they affect other design activities and methods for recording these activities
Staff skills profiles	Milestones during the design and development process, e.g. through specification of life cycle documents
Human-centred methods and tool descriptions	Procedures for ensuring full use of feedback From all pilots, trials and evaluations
Test method descriptions	Suitable timescales to allow feedback to be incorporated into the design schedule
Project management statistics	Assignment of usability objectives to elements of the system
Project monitoring data	Definition of evaluation criteria following from usability objectives
General usability objectives	Indication of test method(s) for evaluations
Human and organisational requirements	Advice on the degree of iteration
	Audit report ³
	Human-centred human factors policy
	HCD process definitions
	HCD support technology specification

³ Evidence for audits includes the following:

Confirmation of context of use information and requirements information by users or their representatives.

Evidence that the: context of use has driven the design process; user and organisational requirements have driven the design process; prototyping and evaluation results have been used to improve and refine the design; sufficient parts of the system were tested to give meaningful results for the system as a whole.

Adequacy of number of users and evidence of their representativeness of those identified in the context of use.

Appropriateness of test methods for the system and context of use, and of the treatment of test results.

Evidence of the competence of the assessor(s) and appropriate selection and use of relevant procedures.

Table 3 - Specify the stakeholder and organisational requirements (HCD.3)

Input	Output
Project scope	The range and relevance of users and other personnel in the design
User representatives	Risk assessment
Work instructions	A statement of the human-centred design goals
Legislation	Stakeholder/User Requirements Specification
Industry, National and International standards	Organisational Requirements Specification
System strategy	Priorities for different requirements
Context of use	Specific, measurable usability goals
Competitor systems	Benchmarks against which the design can be tested
	List of statutory or legislative requirements
	The sources from which the user and organisational requirements were derived

Table 4 - Understand and specify the context of use (HCD.4)

Input	Output
System Requirements	Specification of the range of intended users, tasks and environments
Stakeholder/User Requirements Specification	Stakeholder information
Organisational Requirements Specification	User information
Project scope	Task information
User representatives	Organisational analysis
Work instructions	The sources from which the context of use information was derived
Time and format of the provision of context of use information to the development team	

Table 5 - Produce design solutions (HCD.5)

Input	Output
System Requirements Specification Stakeholder/User Requirements Specification Organisational Requirements Specification Context of use Measurable Usability Goals Ergonomic requirements Standards and Guides Style Guide(s) Expertise Feedback from evaluations	The sources of existing knowledge and the standards used, with an indication of how they have been incorporated (or why they have not been followed, if appropriate) User Interaction Specification Dialogue detail Look and feel Layout and other UI issues Simulations of specification Prototype(s) of parts and all of the system Task model Assignment of functions Worksystem design Evidence of revision in accordance with results of evaluations Training plans for users and maintainers of the system Definition of user support services for the system List of standards used and how applied Justification of deviations from any standard to meet particular requirements Report on how conflicts between design requirements and existing knowledge were dealt with in the design Means of feedback and use of results in other design activities The steps taken to ensure that the prototype(s) covered key requirements and followed good practice

Table 6 - Evaluate designs against requirements (HCD.6)

Input	Output
Project plan	Which parts of the system are to be evaluated and how they are to be evaluated
System Requirements Specification	Context of evaluation
Stakeholder/User Requirements Specification	Full description of the system tested and its status
Organisational Requirements Specification	Number of users taking part in testing, including evidence of adequacy of number of users and their representativeness of those identified in the context of use
Context of use statement	Testing and data collection methods, including evidence of appropriateness of these methods for the system and context use
Measurable Usability Goals	Results in detail and appropriate statistical analysis.
Standards	A report of major and minor non-compliances and observations and an overall assessment
Legislation	A clear pass/fail decision in relation to the requirements
Guidelines	Evidence of the competence of the assessor(s) and the selection and use of relevant procedures
Standards for HF activities	Evidence that sufficient parts of the system were tested to give meaningful results for the system as a whole
Usability audit schedule	Source of evaluation feedback
Test criteria	Usability and ergonomic defects
Testing staff	Recommendations for improvement
Test specifications/plans	Video and audio tapes from trials
Assessment tools	User observation logs
Work instructions	Trial plans and records
Working practices	Revisions to requirements
Users	Interview transcripts
User details	Measurements of ergonomic parameters
Questionnaires	Survey criteria
Roll-out objectives	Survey plan
In-use user and organisational satisfaction objectives	Survey report
Long-term health, safety and well-being objectives	
Description of the usability, health and safety requirements	

Table 7 - Introduce and operate the system (HCD.7)

Input	Output
System/product vision	Implementation development plan
System Requirements Specification	Implementation plan
Stakeholder/User Requirements Specification	Client's representative(s)
Organisational Requirements Specification	Identified stakeholders
Context of Use Statement	Organisation structure
Stakeholder information	Job descriptions
User information	Work Instructions
Task information	Human and Organisation impact assessment
Organisational analysis	Training specifications
User representatives	Training plan
Stakeholder representatives	Training material
Standards, Guidelines and Legislation	Trainer training material
Roll-out/Implementation plan	Impact reports
Client's business plan	Membership of user panel
Training plans for users and maintainers	Monitoring criteria
Definition of user support services	Monitoring programme
	Monitoring reports
	Workplace Audits
	Recommendations for enhancements to the system in the user organisation
	Information for future development projects

Annex 3: Mapping the UMM to ISO 15504

A Human-centred approach to ISO 15504

This section elaborates the ISO 15504 process dimension for Human-Centred processes. For each process, the process category purpose statement defined in Part 2 of ISO 15504 technical report is quoted in italics, followed by a brief description of how a human-centred approach augments ISO 15504 for the whole category and for each process within the category:

The Customer-Supplier process category. *This consists of processes that directly impact the customer and supplier of software systems and services, support development and transition of the software from the supplier to the customer, and provide for its correct operation and use.*

The human-centred aspects concentrate on the involvement of end-users and achieving organisational fit through correct design and training. Consultancy in all aspects of usability assurance is added to this category. The particular human-centred requirements of the processes in this category are given below:

- Acquire software. Ensure that the customer will identify and define the user needs for the system and legislative requirements for the safe installation and operation of the system.
- Manage customer needs process. Ensure that the developing system has precise business needs, that representative users are involved in developing the system and that the system integrates into the working environment.
- Supplying software process. Ensure that the relevant staff are given appropriate training in using the supplied system.
- Operate software process. The organisation is to re-design relevant jobs and practices associated affected by use of the software.
- Provide customer service process. Collect feedback and summarise it, and monitor users' experience with and opinion of the system.

The Engineering process category. *This consists of processes that directly specify, implement, or maintain a system and software system and its user documentation.*

The human-centred aspects concentrate on the elicitation of user requirements, the definition of usability and ergonomic requirements and the activities in the design process which ensure that these requirements are incorporated and tested for in the developing design. The particular human-centred requirements of the processes in this category are given below:

- Develop system requirements process. Generate sets of user, ergonomic⁴ and usability requirements and a definition of the context in which the system will be used.

⁴ This includes relevant statutory and legislative requirements.

- Develop system design process. Take account of the user, ergonomic and usability requirements legacy in the design of the system and to provide the designers with a range of design alternatives for the system, and information about designing for stakeholders.
- Software Requirements, Develop Software Design and Integrate and test software. Not Applicable. Software development is about code, networking and resource issues. Functional issues for the software should have been completely defined in the system requirements. Equally, the above software issues should not have any influence on the system requirements. However, see Manage Risks (MAN 3) and Validation (SUP 5) regarding processes for identifying and managing the discrepancies between required and achievable functional performance.
- Implement software design process. Produce part or complete implementations suitable for usability testing.
- Integrate and test system process. Set up and perform suitable tests or evaluations of the developing or complete system in order to assess the usability or ergonomic quality of the system.
- Maintain system and software process. Use suitable techniques to monitor the use of the system and feed back usability, health and safety, and re-design information.

The Support process category. *This consists of processes which may be employed by any of the other processes (including other supporting processes). The supporting processes can be employed at various points in the software life cycle.*

The human-centred aspects cover the specific support needs of human-centred activities in the lifecycle. In many cases support processes do not require extension. Verification and validation activities have a particular interpretation. The particular human-centred requirements of the processes in this category are given below:

- Develop documentation process. Document the human-centred aspects of the design and design decisions, and to manage the iteration of design solutions.
- Perform configuration management. There are no special configuration support processes but there are new media and document types to configure.
- Perform quality assurance process. Ensure that suitable human-centred methods and supporting knowledge are available in the Quality function.
- Perform work product verification process. Check the developing system against human-centred requirements, standards and legislation to ensure that organisation, task and ergonomic defects are identified.
- Perform work product validation process. Test that the developing system meets organisational and end user requirements as the understanding of the stakeholders develops.
- Perform joint reviews process. Ensure that appropriate user representatives and end-users are consulted during the development of the system.

- Audit practices are as for SPICE assessment model but with the addition of the extra work products.
- Perform Problem Resolution. Although the practices are the same there should be a greater focus on user priorities.

The Management process category. *This consists of processes which contain practices of a generic nature which may be used by anyone who manages any sort of project in a software life cycle, a major one being for system development.*

Achieving high degrees of usability has an effect on all levels of management. This clause extends the SPICE product development view with processes which facilitate usability and a human focus. In addition, the process of supervision is elaborated. The particular human-centred requirements of the processes in this category are given below:

- Manage the Project process. Co-ordinate human-centred activities and other development activities. Assess the user requirements and the specific issues of the planning, equipping and staffing human-centred activities on a project.
- Manage quality process. Ensure that user and organisational issues are addressed at all appropriate stages in the lifecycle and across the range of systems being developed and supported. Usability metrics should be set and assessed. Usability defects should be tracked and corrective action monitored.
- Manage risks process. Use user feedback to prioritise risk management and mitigation activities.
- Manage subcontractors process. Ensure that sub-contractors are capable of using the required human-centred methods.

The Organisation process category. *This consists of processes which establish the business goals of the organisation and develop process, product, and resource assets which, when used by the projects in the organisation, will help the organisation achieve its business goals.*

A human-centred focus requires support in the development organisation. Human-centred base practices are required to ensure a lasting and effective consideration of user issues in a system development organisation. The particular human-centred requirements of the processes in this category are given below:

- Engineer the business process. Establish and maintain the consideration of human issues as core to the organisation and key in the development of successful products and systems.
- Define the process. Integrate a human-centred approach into the process and to consider the ergonomic and usability aspects of systems throughout the lifecycle.
- Improve the process. Take account of usability feedback in developing methods and techniques, to use research results in enhancing or changing methods and tools and to use human-centred methods within the organisation to improve software tools and methods and organisation processes.
- Provide skilled human resources process. Take account of the need for human centred skills.

- Provide software engineering infrastructure process. Define a range of human-centred methods and techniques for use in projects and define the interfaces between their work products and the software engineering process (and vice versa). Check points where user input is required will be defined.

Mapping between models

In the following table the HCD practices have been mapped on to the minimum of 15504 processes. In some cases the fit is somewhat forced because of the difference between the software focus of 15504 and the systems focus of the UMM. The fit between CUS and HCD 1 is forced and in one case (HCD 7.2) it is not possible to force a fit.

ISO 15504 Processes	UMM Practices
	HCD.1 Ensure HCD content in systems strategy
CUS 2	HCD.1.1 Represent stakeholders.
CUS 1	HCD.1.2 Collect market intelligence.
CUS 2	HCD.1.3 Define and plan a system strategy.
CUS 5	HCD.1.4 Collect market feedback.
CUS 1	HCD.1.5 Analyse trends in users
	HCD.2 Plan and manage the HCD process
CUS 2	HCD.2.1 Consult stakeholders.
CUS 2	HCD.2.2 Plan user involvement.
CUS 2	HCD.2.3 Select human-centred methods and techniques.
MAN 1	HCD.2.4 Ensure a human-centred approach within the project team.
MAN 1	HCD.2.5 Plan human-centred design process.
MAN 1	HCD.2.6 Manage human-centred process.
MAN 1	HCD.2.7 Champion human-centred activities
ORG 1	HCD 2.8 Provide support for human-centred design
ORG 5	HCD.3 Specify the User and Organisational Requirements
	HCD.3.1 Clarify and document system goals.
CUS 2	HCD.3.2 Define stakeholders.
CUS 4	HCD.3.3 Assess risk to stakeholders.
ENG 1	HCD.3.4 Define the system.

ENG 1	HCD.3.5 Generate the stakeholder and organizational requirements.
CUS 1	HCD.3.6 Set usability objectives.
	HCD.4 Understand and Specify the Context of Use
ENG 1	HCD.4.2 Identify and document user's tasks.
ENG 1	HCD.4.3 Identify and document significant user attributes.
ENG 1	HCD.4.4 Identify and document organisational environment.
ENG 1	HCD.4.5 Identify and document technical environment.
ENG 1	HCD.4.6 Identify and document physical environment.
	HCD.5 Produce Design Solutions
ENG 1	HCD.5.1 Allocate functions.
ENG 1	HCD.5.2 Produce composite task model.
ENG 1	HCD.5.3 Explore system design.
ENG 1	HCD.5.4 Use existing knowledge to develop design solutions.
ENG 1	HCD.5.5 Specify system and use.
ENG 4	HCD.5.6 Develop prototypes.
ENG 1	HCD.5.7 Develop user training.
ENG 1	HCD.5.8 Develop user support.
	HCD.6 Evaluate Designs against Requirements
SUP 5	HCD.6.1 Specify and validate context of evaluation.
SUP 5	HCD.6.2 Evaluate early prototypes in order to define the requirements for the system.
SUP 5	HCD.6.3 Evaluate prototypes in order to improve the design.
SUP 5	HCD.6.4 Evaluate the system in order to check that the system requirements have been met.
SUP 4	HCD.6.5 Evaluate the system in order to check that the required practice has been followed.
SUP 5	HCD.6.6 Evaluate the system in use in order to ensure that the it continues to meet organisational and user needs.
	HCD.7 Introduce and operate the system
CUS 2	HCD.7.1 Management of change.
n/a	HCD.7.2 Determine impact on organisation and stakeholders.
ENG 7	HCD.7.3 Customisation and local design.

CUS 3	HCD.7.4 Deliver user training.
CUS 5	HCD.7.5 Support users in planned activities.
SUP 4	HCD.7.6 Ensure conformance to workplace ergonomic legislation.

Annex 4: Mapping the UMM to the CMM

Mapping between a ‘full matrix’ model such as the UMM and a key practices or ‘sparse matrix’ model such as the CMM is not easy. However, the following table shows a partial mapping between the processes and practices in the UMM and key process areas (KPAs) from the CMM. Footnotes describe particular interpretations of CMM to address HCD issues.

Some more general interpretations can also be made:

- HCD techniques are especially suitable for implementation of PCM.
- QPM is a generic measure of product and process attributes. If usability is important in products then usability measures should be used to assess the human-centred aspects of the development process.
- HCD is not especially applicable to SPTO and OP, the concerns are different. However, both may use HCD as a solution where appropriate.
- All of HCD may apply to some SSM as a service level agreement.
- SCM applies to all products. The lead assessor should be aware that HCD produces configurable products (e.g. requirements, training, prototypes, manuals etc.).

A general recommendation is for the assessor to have a ‘third eye’ for HCD. When the CMM process under assessment is being done in a human-centred way (i.e. in order to ensure a usable system) the assessor should remember the principles of HCD and check that they are being applied.

CMM Processes	UMM Practices
	HCD.1 Ensure HCD content in systems strategy
RM	HCD.1.1 Represent stakeholders.
IC	HCD.1.2 Collect market intelligence.
SPP	HCD.1.3 Define and plan a system strategy.
SQM	HCD.1.4 Collect market feedback.
IC	HCD.1.5 Analyse trends in users
	HCD.2 Plan and manage the HCD process
IC	HCD.2.1 Consult stakeholders.
IC, PR ⁵	HCD.2.2 Plan user involvement.
SPE, (SQA ⁶)	HCD.2.3 Select human-centred methods and techniques.

⁵ PR is only one type of V&V. HCD 2.3 and 6.n cover a wide range of appropriate reviews for human-centred aspects of systems.

TP	HCD.2.4 Ensure a human-centred approach within the project team.
SPP, ISM	HCD.2.5 Plan human-centred design process.
RM,ISM,	HCD.2.6 Manage human-centred process.
TCM	HCD.2.7 Champion human-centred activities
OPF,OPD ⁷	HCD 2.8 Provide support for human-centred design
SPE	HCD.3 Specify the User and Organisational Requirements
(not SPE)	HCD.3.1 Clarify and document system goals.
RM, IC	HCD.3.2 Define stakeholders.
do. ⁸ (i.e. SPE)	HCD.3.3 Assess risk to stakeholders.
do.	HCD.3.4 Define the system.
do.	HCD.3.5 Generate the stakeholder and organizational requirements.
SQM	HCD.3.6 Set usability objectives.
SPE	HCD.4 Understand and Specify the Context of Use
do.	HCD.4.2 Identify and document user's tasks.
do.	HCD.4.3 Identify and document significant user attributes.
do.	HCD.4.4 Identify and document organisational environment.
do.	HCD.4.5 Identify and document technical environment.
do.	HCD.4.6 Identify and document physical environment.
SPE	HCD.5 Produce Design Solutions
do.	HCD.5.1 Allocate functions.
do.	HCD.5.2 Produce composite task model.
do.	HCD.5.3 Explore system design.
SQA	HCD.5.4 Use existing knowledge to develop design solutions.
do. (i.e. SPE)	HCD.5.5 Specify system and use.
do.	HCD.5.6 Develop prototypes.
do.	HCD.5.7 Develop user training.

⁶ There may be a QA requirement defined in SQA to use UMM on the project.

⁷ When assessing OPF & OPD look for inclusion of HCD.

⁸ 'do.' against base practices indicate that the practice is below the level of detail of CMM. In these cases the practice is assigned to the same KPA as its process.

do.	HCD.5.8 Develop user support.
SPE, SQM ⁹ (not SQM)	HCD.6 Evaluate Designs against Requirements
do. (SPE, SQM)	HCD.6.1 Specify and validate context of evaluation.
do.	HCD.6.2 Evaluate early prototypes in order to define the requirements for the system.
do.	HCD.6.3 Evaluate prototypes in order to improve the design.
do.	HCD.6.4 Evaluate the system in order to check that the system requirements have been met.
SQA	HCD.6.5 Evaluate the system in order to check that the required practice has been followed.
do. (SPE,SQM)	HCD.6.6 Evaluate the system in use in order to ensure that the it continues to meet organisational and user needs.
RM	HCD.7 Introduce and operate the system
n/a	HCD.7.1 Management of change.
n/a	HCD.7.2 Determine impact on organisation and stakeholders.
n/a	HCD.7.3 Customisation and local design.
n/a	HCD.7.4 Deliver user training.
n/a	HCD.7.5 Support users in planned activities.
SQA ¹⁰	HCD.7.6 Ensure conformance to workplace ergonomic legislation.

⁹ SQM quality measure also has a place in HCD.

¹⁰ There may be changes in what is required in the way of conformance through the life of the system.

Annex 5: Mapping the UMM to the SE-CMM

SE-CMM Processes	UMM Practices
	HCD.1 Ensure HCD content in systems strategy
PA06	HCD.1.1 Represent stakeholders.
PA06	HCD.1.2 Collect market intelligence.
PA15	HCD.1.3 Define and plan a system strategy.
PA06	HCD.1.4 Collect market feedback.
PA06	HCD.1.5 Analyse trends in users
	HCD.2 Plan and manage the HCD process
PA06	HCD.2.1 Consult stakeholders.
PA06	HCD.2.2 Plan user involvement.
PA12	HCD.2.3 Select human-centred methods and techniques.
PA12	HCD.2.4 Ensure a human-centred approach within the project team.
PA04	HCD.2.5 Plan human-centred design process.
PA12	HCD.2.6 Manage human-centred process.
PA11	HCD.2.7 Champion human-centred activities
PA13	HCD.2.8 Provide support for human-centred design
PA16	HCD.3 Specify the User and Organisational Requirements
	HCD.3.1 Clarify and document system goals.
PA02	HCD.3.2 Define stakeholders.
PA06	HCD.3.3 Assess risk to stakeholders.
PA02	HCD.3.4 Define the system.
PA02	HCD.3.5 Generate the stakeholder and organizational requirements.
PA02	HCD.3.6 Set usability objectives.
	HCD.4 Understand and Specify the Context of Use
PA02/06	HCD.4.2 Identify and document user's tasks.
PA06	HCD.4.3 Identify and document significant user attributes.
PA06	HCD.4.4 Identify and document organisational environment.

PA06	HCD.4.5 Identify and document technical environment.
PA06	HCD.4.6 Identify and document physical environment.
	HCD.5 Produce Design Solutions
PA02	HCD.5.1 Allocate functions.
PA02	HCD.5.2 Produce composite task model.
PA01	HCD.5.3 Explore system design.
PA01	HCD.5.4 Use existing knowledge to develop design solutions.
n/a	HCD.5.5 Specify system and use.
n/a	HCD.5.6 Develop prototypes.
n/a	HCD.5.7 Develop user training.
n/a	HCD.5.8 Develop user support.
	HCD.6 Evaluate Designs against Requirements
PA06	HCD.6.1 Specify and validate context of evaluation.
PA07	HCD.6.2 Evaluate early prototypes in order to define the requirements for the system.
PA07	HCD.6.3 Evaluate prototypes in order to improve the design.
PA07	HCD.6.4 Evaluate the system in order to check that the system requirements have been met.
PA07	HCD.6.5 Evaluate the system in order to check that the required practice has been followed.
PA07	HCD.6.6 Evaluate the system in use in order to ensure that the it continues to meet organisational and user needs.
	HCD.7 Introduce and operate the system
PA06	HCD.7.1 Management of change.
PA06	HCD.7.2 Determine impact on organisation and stakeholders.
n/a	HCD.7.3 Customisation and local design.
n/a	HCD.7.4 Deliver user training.
n/a	HCD.7.5 Support users in planned activities.
PA07	HCD.7.6 Ensure conformance to workplace ergonomic legislation.

Annex 6: Hints for Assessments and Interviews

Interviews tend to take around an hour a process or three to four hours for whole process category (such as the HCD processes). However, in most assessments very few categories will be covered in full. If evidence (work products) is not immediately available either the time will increase or the integrity of the assessment will fall.

The assessment team should ideally have a day's familiarisation with the industrial sector in which the assessee operates and the project(s) under assessment. At an early stage, the terms of reference with respect to (a) confidentiality and (b) reporting, must be agreed. These are strong determinants of assessee behaviour and as such strongly impact the findings of an assessment.

Some specialist words can get in the way of understanding. It is strongly recommended that the lead assessor and the client should prepare a mapping of the assessee's processes against the processes and practices in the assessment model to give the assessor more context for the assessment. This also produces a common language for the assessment. In an ideal case the assessee would carry out a preliminary exercise to define how the project and organisational processes and practices meet the requirements of the UMM.

First and second party assessments will proceed more efficiently if the client and the assessor discuss the known problems before the interviews begin. Obviously in third party assessments the client is unlikely to be open about any problems.

On occasion clients may require confidentiality regarding the purpose of a project. Although it is possible to do an assessment without knowing the purpose of the project it is necessary to know the scope of the project.

When UMM processes are used in another process model the interviewer will need a good knowledge of human-centred process technology. Ideally, two assessors should be used: one with expertise in the relevant process/capability model and one with expertise in Human Factors.

The interview process is best based on discussion and reflection of observations for conformation rather than focused questions. Interviews should concentrate on the process; the interviewer should make very clear that the interviewee is not being assessed. Normal practice is to take two views of each category for each project, one from the worker's point of view and one from the manager's. For reasons of anonymity, and so as to attain a meaningful and representative measure, more than one project should be assessed. The precise number depends on the size of the organisation.

During interviews the assessor and assessee need to focus on the particular process under discussion. There is a tendency for an interviewee who cannot see the model and simply answers questions to drift and give misleading answers about capability. Such answers are often more related to the overall picture than the particular process being assessed. Detailed knowledge on the part of the assessor, and experience of the client's terminology and way of working help the interviewee

to focus. A co-operative style is preferred for speed and veracity. The interviewer should sit next to the interviewee.

Process Assessment relies heavily on the knowledge of the assessor to bring out how things are done and then rate them against the processes and the capability scale (which define what should be done to achieve quality in an organisation). The assessor needs to keep a clear focus on the model of what should be done as intended in the model. After the tailoring process the assessor should trust the model in use absolutely and never demote or interpret particular practices or attributes.

At an abstract level it is easy for the discussion to lose focus. Evidence restores the focus. The interviewer should ask to see work products whenever there seems to be uncertainty.

The N/P/L/F rating for process attributes allows the assessor to give the benefit of the doubt for any one management practice. However, its use for rating base practices can lead to lengthy discussion which sits more happily during the rating discussion. It is advised that the base practice rating discussion should be managed carefully and the overall assessment of N/P/L/F should also be based on a general consideration of quality of performance of the base practices.

Assessment should be 'two-eyed'. The reasons for problems should be collected at the same time as the formal assessment scores.

Annex 7: Sample Recording Form

Use of the recording form

Index of fields:

attribute number	attribute name	1 (use this column for the first interview)	2 (use this column for a second interview)	3 (use this column for a third interview)	rating
practice number	practice name	<i>data entry field 1.1</i>	<i>data entry field 2.1</i>	<i>data entry field 3.1</i>	
-do-	-do-	<i>data entry field 1.n</i>	<i>data entry field 2.n</i>	<i>data entry field 3.n</i>	
	combined rating for attribute (An.1 to n.m):	<i>record the combination ratings for this column here</i>	<i>record the combination ratings for this column here</i>	<i>record the combination ratings for this column here</i>	<i>record the combination of this row here</i>
	combination of ratings for this level:				<i>record the combination for this level here</i>

Sequence to be followed when using the recording form:

1. (optional) Set the maximum level (ceiling) to which the assessment will proceed. This should be agreed between the assessee and the client organisation. It speeds up the interview and, for assessments of organisations which believe themselves to be of relatively low maturity, avoids negative reinforcement.
2. Use a new form for each project and a new column for each interview.
3. For each **level** in turn rate the **attributes** by rating the **practices**.
4. Rate each practice in turn by asking questions and asking for evidence.
5. Record your estimate of how completely the practice is performed in the relevant 'data entry' fields, using the following scale:
 - **N** No evidence of achievement of the defined practice.
 - **P** Some achievement of the defined practice.
 - **L** Significant achievement of the defined practice.
 - **F** Full achievement of the defined practice.
6. If there is some doubt as to how completely a practice is achieved give the benefit of the doubt and rate at the higher level of achievement.
7. Repeat the process for the next attribute.
8. Repeat the process for the next level until there is no evidence of performance of any practices from that level, or until the ceiling set on assessment is reached.
9. (optional) If the ceiling was reached and the practices at that level are being performed then offer the option of continuing the assessment to higher levels.
10. Combine the ratings for each attribute. Once again, give the benefit of the doubt and round up if required.
11. If more than one interview has been carried out, assess the combination of the ratings using the box in the rightmost column.
12. Combine the ratings for all of the attributes at each level using the box in the bottom right hand corner of each table.

Recording form

HCD.1 Ensure HCD content in system strategy

Ref.	Processes and Practices	1	2	3	rating ¹¹
Level 1	Performed Process				
PA1.1	Process performance attribute				
HCD.1.1	Represent stakeholders.				
HCD.1.2	Collect market intelligence.				
HCD.1.3	Define and plan a system strategy.				
HCD.1.4	Collect market feedback.				
HCD.1.5	Analyse trends in users.				
	Combined rating for attribute (i.e. combine ratings for process) (HCD.1.1 to 1.5):				
Level 2	Managed Process				
PA2.1	Performance management attribute				
MP2.1.1	Identify resource requirements				
MP2.1.2	Plan the performance of the process				
MP2.1.3	Implement the defined activities				
MP2.1.4	Manage the execution of the activities				
	Combined rating for attribute (MP2.1.1 to 2.1.4):				
PA 2.2	Work product management attribute				
MP2.2.1	Identify requirements				
MP2.2.2	Identify the activities needed				
MP2.2.3	Manage the configuration of work products				
MP2.2.4	Manage the quality of work products				
	Combined rating for attribute (MP2.2.1 to 2.2.4):				
	Combination of ratings for this level:				
Level 3	Established Process				
PA3.1	Process definition attribute				
MP3.1.1	Identify the standard process definition				
MP3.1.2	Tailor the standard process				
MP3.1.3	Implement the defined process				

¹¹ Combination of responses for interviewees 1 to 3. If value is between ratings take the higher rating.

MP3.1.4	Provide feedback				
	Combined rating for attribute (MP3.1.1 to 3.1.4):				
PA 3.2	Process resource attribute				
MP3.2.1	Define the human resource competencies				
MP3.2.2	Define process infrastructure requirements				
MP3.2.3	Provide adequate skilled human resources				
MP3.2.4	Provide adequate process infrastructure				
	Combined rating for attribute (MP3.2.1 to 3.2.4):				
	Combination of ratings for this level:				
Level 4	Predictable process				
PA4.1	Process measurement attribute				
MP4.1.1	Define process goals and associated measures				
MP4.1.2	Provide adequate resources and infrastructure for data collection.				
MP4.1.3	Collect the specified measurement data.				
MP4.1.4	Evaluate achievement of process goals				
	Combined rating for attribute (MP4.1.1 to 4.1.4):				
PA 4.2	Process control attribute				
MP4.2.1	Identify analysis and control techniques.				
MP4.2.2	Provide adequate resources and infrastructure				
MP4.2.3	Analyse available measures				
MP4.2.4	Identify deviations and take required control actions				
	Combined rating for attribute (MP4.2.1 to 4.2.4):				
	Combination of ratings for this level:				
Level 5	Optimising Process				
PA5.1	Process change attribute				
MP5.1.1	Identify and approve changes to the standard process definition.				
MP5.1.2	Provide adequate resources				
MP5.1.3	Implement the approved changes to the affected tailored				
MP5.1.4	Validate the effectiveness of process change				
	Combined rating for attribute (MP5.1.1				

	to 5.1.4):				
PA 5.2	Continuous improvement attribute				
MP5.2.1	Identify improvement opportunities				
MP5.2.2	Establish an implementation strategy				
MP5.2.3	Implement changes to selected areas of the tailored process				
MP5.2.4	Validate the effectiveness of process change				
	Combined rating for attribute (MP5.2.1 to 5.2.4):				
	Combination of ratings for this level:				

***HCD.2 Plan and manage the HCD process**

Ref.	Processes and Practices	1	2	3	rating
Level 1	Performed Process				
PA1.1	Process performance attribute				
HCD.2.1	Consult stakeholders.				
HCD.2.2	Plan user involvement.				
HCD.2.3	Select human-centred methods and techniques.				
HCD.2.4	Ensure a human-centred approach within the project team.				
HCD.2.5	Plan human-centred design process.				
HCD.2.6	Manage human-centred process.				
HCD.2.7	Champion human-centred activities.				
HCD.2.8	Provide support for human-centred design.				
	Combined rating for attribute (i.e. combine ratings for process) (HCD.2.1 to 2.8):				
Level 2	Managed Process				
PA2.1	Performance management attribute				
MP2.1.1	Identify resource requirements				
MP2.1.2	Plan the performance of the process				
MP2.1.3	Implement the defined activities				
MP2.1.4	Manage the execution of the activities				
	Combined rating for attribute (MP2.1.1 to 2.1.4):				
PA 2.2	Work product management attribute				
MP2.2.1	Identify requirements				
MP2.2.2	Identify the activities needed				
MP2.2.3	Manage the configuration of work products				
MP2.2.4	Manage the quality of work products				
	Combined rating for attribute (MP2.2.1 to 2.2.4):				
	Combination of ratings for this level:				
Level 3	Established Process				
PA3.1	Process definition attribute				
MP3.1.1	Identify the standard process definition				
MP3.1.2	Tailor the standard process				

MP3.1.3	Implement the defined process				
MP3.1.4	Provide feedback				
	Combined rating for attribute (MP3.1.1 to 3.1.4):				
PA 3.2	Process resource attribute				
MP3.2.1	Define the human resource competencies				
MP3.2.2	Define process infrastructure requirements				
MP3.2.3	Provide adequate skilled human resources				
MP3.2.4	Provide adequate process infrastructure				
	Combined rating for attribute (MP3.2.1 to 3.2.4):				
	Combination of ratings for this level:				
Level 4	Predictable process				
PA4.1	Process measurement attribute				
MP4.1.1	Define process goals and associated measures				
MP4.1.2	Provide adequate resources and infrastructure for data collection.				
MP4.1.3	Collect the specified measurement data.				
MP4.1.4	Evaluate achievement of process goals				
	Combined rating for attribute (MP4.1.1 to 4.1.4):				
PA 4.2	Process control attribute				
MP4.2.1	Identify analysis and control techniques.				
MP4.2.2	Provide adequate resources and infrastructure				
MP4.2.3	Analyse available measures				
MP4.2.4	Identify deviations and take required control actions				
	Combined rating for attribute (MP4.2.1 to 4.2.4):				
	Combination of ratings for this level:				
Level 5	Optimising Process				
PA5.1	Process change attribute				
MP5.1.1	Identify and approve changes to the standard process definition.				
MP5.1.2	Provide adequate resources				
MP5.1.3	Implement the approved changes to the affected tailored				
MP5.1.4	Validate the effectiveness of process change				

	Combined rating for attribute (MP5.1.1 to 5.1.4):				
PA 5.2	Continuous improvement attribute				
MP5.2.1	Identify improvement opportunities				
MP5.2.2	Establish an implementation strategy				
MP5.2.3	Implement changes to selected areas of the tailored process				
MP5.2.4	Validate the effectiveness of process change				
	Combined rating for attribute (MP5.2.1 to 5.2.4):				
	Combination of ratings for this level:				

HCD.3 Specify the user and organisational requirements

Ref.	Processes and Practices	1	2	3	rating
Level 1	Performed Process				
PA1.1	Process performance attribute				
HCD.3.1	Clarify and document the system goals.				
HCD.3.2	Analyse stakeholders.				
HCD.3.3	Assess H&S risk to stakeholders.				
HCD.3.4	Define the system.				
HCD.3.5	Generate the stakeholder and organisational requirements.				
HCD.3.6	Set quality in use objectives.				
	Combined rating for attribute (i.e. combine ratings for process) (HCD.3.1 to 3.5):				
Level 2	Managed Process				
PA2.1	Performance management attribute				
MP2.1.1	Identify resource requirements				
MP2.1.2	Plan the performance of the process				
MP2.1.3	Implement the defined activities				
MP2.1.4	Manage the execution of the activities				
	Combined rating for attribute (MP2.1.1 to 2.1.4):				
PA 2.2	Work product management attribute				
MP2.2.1	Identify requirements				
MP2.2.2	Identify the activities needed				
MP2.2.3	Manage the configuration of work products				
MP2.2.4	Manage the quality of work products				
	Combined rating for attribute (MP2.2.1 to 2.2.4):				
	Combination of ratings for this level:				
Level 3	Established Process				
PA3.1	Process definition attribute				
MP3.1.1	Identify the standard process definition				
MP3.1.2	Tailor the standard process				
MP3.1.3	Implement the defined process				
MP3.1.4	Provide feedback				
	Combined rating for attribute (MP3.1.1				

	to 3.1.4):				
PA 3.2	Process resource attribute				
MP3.2.1	Define the human resource competencies				
MP3.2.2	Define process infrastructure requirements				
MP3.2.3	Provide adequate skilled human resources				
MP3.2.4	Provide adequate process infrastructure				
	Combined rating for attribute (MP3.2.1 to 3.2.4):				
	Combination of ratings for this level:				
Level 4	Predictable process				
PA4.1	Process measurement attribute				
MP4.1.1	Define process goals and associated measures				
MP4.1.2	Provide adequate resources and infrastructure for data collection.				
MP4.1.3	Collect the specified measurement data.				
MP4.1.4	Evaluate achievement of process goals				
	Combined rating for attribute (MP4.1.1 to 4.1.4):				
PA 4.2	Process control attribute				
MP4.2.1	Identify analysis and control techniques.				
MP4.2.2	Provide adequate resources and infrastructure				
MP4.2.3	Analyse available measures				
MP4.2.4	Identify deviations and take required control actions				
	Combined rating for attribute (MP4.2.1 to 4.2.4):				
	Combination of ratings for this level:				
Level 5	Optimising Process				
PA5.1	Process change attribute				
MP5.1.1	Identify and approve changes to the standard process definition.				
MP5.1.2	Provide adequate resources				
MP5.1.3	Implement the approved changes to the affected tailored				
MP5.1.4	Validate the effectiveness of process change				
	Combined rating for attribute (MP5.1.1 to 5.1.4):				
PA 5.2	Continuous improvement attribute				

MP5.2.1	Identify improvement opportunities				
MP5.2.2	Establish an implementation strategy				
MP5.2.3	Implement changes to selected areas of the tailored process				
MP5.2.4	Validate the effectiveness of process change				
	Combined rating for attribute (MP5.2.1 to 5.2.4):				
	Combination of ratings for this level:				

HCD.4 Understand and specify the context of use

Ref.	Processes and Practices	1	2	3	rating
Level 1	Performed Process				
PA1.1	Process performance attribute				
HCD.4.1	Identify and document user's tasks.				
HCD.4.2	Identify and document significant user attributes.				
HCD.4.3	Identify and document organisational environment.				
HCD.4.4	Identify and document technical environment.				
HCD.4.5	Identify and document physical environment.				
	Combined rating for attribute (i.e. combine ratings for process) (HCD.4.1 to 4.5):				
Level 2	Managed Process				
PA2.1	Performance management attribute				
MP2.1.1	Identify resource requirements				
MP2.1.2	Plan the performance of the process				
MP2.1.3	Implement the defined activities				
MP2.1.4	Manage the execution of the activities				
	Combined rating for attribute (MP2.1.1 to 2.1.4):				
PA 2.2	Work product management attribute				
MP2.2.1	Identify requirements				
MP2.2.2	Identify the activities needed				
MP2.2.3	Manage the configuration of work products				
MP2.2.4	Manage the quality of work products				
	Combined rating for attribute (MP2.2.1 to 2.2.4):				
	Combination of ratings for this level:				
Level 3	Established Process				
PA3.1	Process definition attribute				
MP3.1.1	Identify the standard process definition				
MP3.1.2	Tailor the standard process				
MP3.1.3	Implement the defined process				
MP3.1.4	Provide feedback				
	Combined rating for attribute (MP3.1.1				

	to 3.1.4):				
PA 3.2	Process resource attribute				
MP3.2.1	Define the human resource competencies				
MP3.2.2	Define process infrastructure requirements				
MP3.2.3	Provide adequate skilled human resources				
MP3.2.4	Provide adequate process infrastructure				
	Combined rating for attribute (MP3.2.1 to 3.2.4):				
	Combination of ratings for this level:				
Level 4	Predictable process				
PA4.1	Process measurement attribute				
MP4.1.1	Define process goals and associated measures				
MP4.1.2	Provide adequate resources and infrastructure for data collection.				
MP4.1.3	Collect the specified measurement data.				
MP4.1.4	Evaluate achievement of process goals				
	Combined rating for attribute (MP4.1.1 to 4.1.4):				
PA 4.2	Process control attribute				
MP4.2.1	Identify analysis and control techniques.				
MP4.2.2	Provide adequate resources and infrastructure				
MP4.2.3	Analyse available measures				
MP4.2.4	Identify deviations and take required control actions				
	Combined rating for attribute (MP4.2.1 to 4.2.4):				
	Combination of ratings for this level:				
Level 5	Optimising Process				
PA5.1	Process change attribute				
MP5.1.1	Identify and approve changes to the standard process definition.				
MP5.1.2	Provide adequate resources				
MP5.1.3	Implement the approved changes to the affected tailored				
MP5.1.4	Validate the effectiveness of process change				
	Combined rating for attribute (MP5.1.1 to 5.1.4):				
PA 5.2	Continuous improvement attribute				

MP5.2.1	Identify improvement opportunities				
MP5.2.2	Establish an implementation strategy				
MP5.2.3	Implement changes to selected areas of the tailored process				
MP5.2.4	Validate the effectiveness of process change				
	Combined rating for attribute (MP5.2.1 to 5.2.4):				
	Combination of ratings for this level:				

HCD.5 Produce design solutions

Ref.	Processes and Practices	1	2	3	rating
Level 1	Performed Process				
PA1.1	Process performance attribute				
HCD.5.1	Allocate functions.				
HCD.5.2	Produce composite task model.				
HCD.5.3	Produce system design.				
HCD.5.4	Use existing knowledge to develop design solutions.				
HCD.5.5	Specify system.				
HCD.5.6	Develop prototypes.				
HCD.5.7	Develop user training.				
HCD.5.8	Develop user support.				
	Combined rating for attribute (i.e. combine ratings for process) (HCD.5.1 to 5.8):				
Level 2	Managed Process				
PA2.1	Performance management attribute				
MP2.1.1	Identify resource requirements				
MP2.1.2	Plan the performance of the process				
MP2.1.3	Implement the defined activities				
MP2.1.4	Manage the execution of the activities				
	Combined rating for attribute (MP2.1.1 to 2.1.4):				
PA 2.2	Work product management attribute				
MP2.2.1	Identify requirements				
MP2.2.2	Identify the activities needed				
MP2.2.3	Manage the configuration of work products				
MP2.2.4	Manage the quality of work products				
	Combined rating for attribute (MP2.2.1 to 2.2.4):				
	Combination of ratings for this level:				
Level 3	Established Process				
PA3.1	Process definition attribute				
MP3.1.1	Identify the standard process definition				
MP3.1.2	Tailor the standard process				
MP3.1.3	Implement the defined process				

MP3.1.4	Provide feedback				
	Combined rating for attribute (MP3.1.1 to 3.1.4):				
PA 3.2	Process resource attribute				
MP3.2.1	Define the human resource competencies				
MP3.2.2	Define process infrastructure requirements				
MP3.2.3	Provide adequate skilled human resources				
MP3.2.4	Provide adequate process infrastructure				
	Combined rating for attribute (MP3.2.1 to 3.2.4):				
	Combination of ratings for this level:				
Level 4	Predictable process				
PA4.1	Process measurement attribute				
MP4.1.1	Define process goals and associated measures				
MP4.1.2	Provide adequate resources and infrastructure for data collection.				
MP4.1.3	Collect the specified measurement data.				
MP4.1.4	Evaluate achievement of process goals				
	Combined rating for attribute (MP4.1.1 to 4.1.4):				
PA 4.2	Process control attribute				
MP4.2.1	Identify analysis and control techniques.				
MP4.2.2	Provide adequate resources and infrastructure				
MP4.2.3	Analyse available measures				
MP4.2.4	Identify deviations and take required control actions				
	Combined rating for attribute (MP4.2.1 to 4.2.4):				
	Combination of ratings for this level:				
Level 5	Optimising Process				
PA5.1	Process change attribute				
MP5.1.1	Identify and approve changes to the standard process definition.				
MP5.1.2	Provide adequate resources				
MP5.1.3	Implement the approved changes to the affected tailored				
MP5.1.4	Validate the effectiveness of process change				
	Combined rating for attribute (MP5.1.1				

	to 5.1.4):				
PA 5.2	Continuous improvement attribute				
MP5.2.1	Identify improvement opportunities				
MP5.2.2	Establish an implementation strategy				
MP5.2.3	Implement changes to selected areas of the tailored process				
MP5.2.4	Validate the effectiveness of process change				
	Combined rating for attribute (MP5.2.1 to 5.2.4):				
	Combination of ratings for this level:				

HCD.6 Evaluate designs against requirements

Ref.	Processes and Practices	1	2	3	rating
Level 1	Performed Process				
PA1.1	Process performance attribute				
HCD.6.1	Specify and validate context of evaluation.				
HCD.6.2	Evaluate early prototypes in order to define the requirements for the system.				
HCD.6.3	Evaluate prototypes in order to improve the design.				
HCD.6.4	Evaluate the system in order to check that the system requirements have been met.				
HCD.6.5	Evaluate the system in order to check that the required practice has been followed.				
HCD.6.6	Evaluate the system in use in order to ensure that it continues to meet organisational and user needs.				
	Combined rating for attribute (i.e. combine ratings for process) (HCD.6.1 to 6.6):				
Level 2	Managed Process				
PA2.1	Performance management attribute				
MP2.1.1	Identify resource requirements				
MP2.1.2	Plan the performance of the process				
MP2.1.3	Implement the defined activities				
MP2.1.4	Manage the execution of the activities				
	Combined rating for attribute (MP2.1.1 to 2.1.4):				
PA 2.2	Work product management attribute				
MP2.2.1	Identify requirements				
MP2.2.2	Identify the activities needed				
MP2.2.3	Manage the configuration of work products				
MP2.2.4	Manage the quality of work products				
	Combined rating for attribute (MP2.2.1 to 2.2.4):				
	Combination of ratings for this level:				
Level 3	Established Process				
PA3.1	Process definition attribute				
MP3.1.1	Identify the standard process definition				
MP3.1.2	Tailor the standard process				

MP3.1.3	Implement the defined process				
MP3.1.4	Provide feedback				
	Combined rating for attribute (MP3.1.1 to 3.1.4):				
PA 3.2	Process resource attribute				
MP3.2.1	Define the human resource competencies				
MP3.2.2	Define process infrastructure requirements				
MP3.2.3	Provide adequate skilled human resources				
MP3.2.4	Provide adequate process infrastructure				
	Combined rating for attribute (MP3.2.1 to 3.2.4):				
	Combination of ratings for this level:				
Level 4	Predictable process				
PA4.1	Process measurement attribute				
MP4.1.1	Define process goals and associated measures				
MP4.1.2	Provide adequate resources and infrastructure for data collection.				
MP4.1.3	Collect the specified measurement data.				
MP4.1.4	Evaluate achievement of process goals				
	Combined rating for attribute (MP4.1.1 to 4.1.4):				
PA 4.2	Process control attribute				
MP4.2.1	Identify analysis and control techniques.				
MP4.2.2	Provide adequate resources and infrastructure				
MP4.2.3	Analyse available measures				
MP4.2.4	Identify deviations and take required control actions				
	Combined rating for attribute (MP4.2.1 to 4.2.4):				
	Combination of ratings for this level:				
Level 5	Optimising Process				
PA5.1	Process change attribute				
MP5.1.1	Identify and approve changes to the standard process definition.				
MP5.1.2	Provide adequate resources				
MP5.1.3	Implement the approved changes to the affected tailored				
MP5.1.4	Validate the effectiveness of process change				

	Combined rating for attribute (MP5.1.1 to 5.1.4):				
PA 5.2	Continuous improvement attribute				
MP5.2.1	Identify improvement opportunities				
MP5.2.2	Establish an implementation strategy				
MP5.2.3	Implement changes to selected areas of the tailored process				
MP5.2.4	Validate the effectiveness of process change				
	Combined rating for attribute (MP5.2.1 to 5.2.4):				
	Combination of ratings for this level:				

***HCD.7 Introduce and operate the system**

Ref.	Processes and Practices	1	2	3	rating
Level 1	Performed Process				
PA1.1	Process performance attribute				
HCD.7.1	Manage change.				
HCD.7.2	Determine impact on organisation and stakeholders.				
HCD.7.3	Customisation and local design.				
HCD.7.4	Deliver user training.				
HCD.7.5	Support users in planned activities.				
HCD.7.6	Ensure conformance to workplace ergonomic legislation.				
	Combined rating for attribute (i.e. combine ratings for process) (HCD.7.1 to 7.6):				
Level 2	Managed Process				
PA2.1	Performance management attribute				
MP2.1.1	Identify resource requirements				
MP2.1.2	Plan the performance of the process				
MP2.1.3	Implement the defined activities				
MP2.1.4	Manage the execution of the activities				
	Combined rating for attribute (MP2.1.1 to 2.1.4):				
PA 2.2	Work product management attribute				
MP2.2.1	Identify requirements				
MP2.2.2	Identify the activities needed				
MP2.2.3	Manage the configuration of work products				
MP2.2.4	Manage the quality of work products				
	Average rating for attribute (MP2.2.1 to 2.2.4):				
	Combination of ratings for this level:				
Level 3	Established Process				
PA3.1	Process definition attribute				
MP3.1.1	Identify the standard process definition				
MP3.1.2	Tailor the standard process				
MP3.1.3	Implement the defined process				
MP3.1.4	Provide feedback				

	Combined rating for attribute (MP3.1.1 to 3.1.4):				
PA 3.2	Process resource attribute				
MP3.2.1	Define the human resource competencies				
MP3.2.2	Define process infrastructure requirements				
MP3.2.3	Provide adequate skilled human resources				
MP3.2.4	Provide adequate process infrastructure				
	Combined rating for attribute (MP3.2.1 to 3.2.4):				
	Combination of ratings for this level:				
Level 4	Predictable process				
PA4.1	Process measurement attribute				
MP4.1.1	Define process goals and associated measures				
MP4.1.2	Provide adequate resources and infrastructure for data collection.				
MP4.1.3	Collect the specified measurement data.				
MP4.1.4	Evaluate achievement of process goals				
	Combined rating for attribute (MP4.1.1 to 4.1.4):				
PA 4.2	Process control attribute				
MP4.2.1	Identify analysis and control techniques.				
MP4.2.2	Provide adequate resources and infrastructure				
MP4.2.3	Analyse available measures				
MP4.2.4	Identify deviations and take required control actions				
	Combined rating for attribute (MP4.2.1 to 4.2.4):				
	Combination of ratings for this level:				
Level 5	Optimising Process				
PA5.1	Process change attribute				
MP5.1.1	Identify and approve changes to the standard process definition.				
MP5.1.2	Provide adequate resources				
MP5.1.3	Implement the approved changes to the affected tailored				
MP5.1.4	Validate the effectiveness of process change				
	Combined rating for attribute (MP5.1.1 to 5.1.4):				

PA 5.2	Continuous improvement attribute				
MP5.2.1	Identify improvement opportunities				
MP5.2.2	Establish an implementation strategy				
MP5.2.3	Implement changes to selected areas of the tailored process				
MP5.2.4	Validate the effectiveness of process change				
	Combined rating for attribute (MP5.2.1 to 5.2.4):				
	Combination of ratings for this level:				

Annex 8: ISO 15504 Conformance Statement

ISO TR 15504 places conformance requirements on capability models. The following sections quote the requirements for process models and present how these have been met in the current document.

7.2 Model purpose

“A model, based on good software engineering and process management principles, shall be developed, or have been developed, for the purpose of assessing software process capability.”

The model given in this document has been developed for the purpose of assessing system development processes which may include the development of software elements.

7.3 Model scope

“A model shall encompass all, or a non-empty subset, of the set of processes in the process dimension of the reference model contained in this part of the Technical Report.

The developer of the model shall declare its scope of coverage in the terms of both the process and capability dimensions of the reference model contained in this part of the Technical Report.”

The model provides an extension to the processes in the 15504 reference model in the area of Human-centred issues. It encompasses almost all processes in the reference model. The exact coverage is given in Annex 3.

The model uses the ISO 15504 capability scale. Its coverage is therefore identical to that of ISO 15504.

7.4 Model elements and indicators

“A model shall be based on a set of elements that explicitly address the purposes, as defined in the reference model in this part of the Technical Report, of all the processes within the scope of the model, and that demonstrate the achievement of the process attributes within the capability level scope of the model.

In the process dimension, the detailed elements of the model shall constitute a set of indicators of process performance that focus attention on the effective implementation of processes through their work products.

The process dimension of the human-centred process model consists of a set of base practices and associated work products which focus attention on the effective implementation of human-centred activities within the system development lifecycle.

The capability dimension of the human-centred process model is the same as for ISO 15504.

7.5 Mapping

“The developer of a model shall provide an explicit mapping from the fundamental elements of the model to the processes and process attributes of the reference model contained in this part of the Technical Report.

The mapping shall be complete, clear, and unambiguous and shall substantiate the declaration of the scope of coverage.

In the process dimension, the mapping shall include the mapping of the indicators of process performance within the model to the purposes of the processes in the reference model.

A mapping between the human-centred process model in this document and ISO 15504 part 2 is given in Annex 3 of this document. This mapping allocates the base practices in the human-centred process model to processes in ISO 15504.

7.6 Translation

“The developer of a model shall provide a formal and verifiable mechanism for converting data collected against the model into sets of process attribute ratings for each process instance assessed as defined in 6.7 of this part of the Technical Report, and in part 3.”

The model is intended for use with the assessment process and ratings defined in ISO 15504 Part 5.

Annex 9: Contributors to the Model

The following people assisted in the development of the model presented in this document through one or more of the following: provision of material, advice, support, insight and review of the developing document. Many people contributed a great deal in many different ways. It is therefore, regretfully, not possible to acknowledge the invaluable assistance of the contributors in other than alphabetical order.

name	affiliation
Nigel Bevan	National Physical Laboratory
Charles Brennan	BT HF Unit
Mac Craigmyle	COMPITA
John Cato	Software Design and Build
Andrea Caws	System Concepts
Nigel Claridge and Tomas Berns	NOMOS management AB
Amos Cleeve	EDS
Ian Clowes	Logica UK Ltd
Hazel Courteney	CAA, Safety and Reliability Group
Peter Essens	TNO
Professor Ken Eason and Susan Harker	Dept of Human Sciences Loughborough University
Alain Fasiender	MAP Systeme
George Flanagan	IBM Consulting
Greg Garison	Reuters
Anna Giannetti	Sogei
Mike Goom and David Sully	Matra BAe Dynamics
Ashok Gupta	Philips Research, Redhill
Simon Hakiel	IBM UK Labs
Bill Hefley	Software Engineering Institute
Mike Kelly	ConsultancyM
Jurek Kirakowski	Cork University, HFRG
David Jennings	British HCI Group
Pirkko Jokela	TeamWare Group
Timo Jokela	Nokia Mobile Phones

Ilka Kuulvanianen and Juha Rikkila	Nokia Research Centre
Jerry Lake	Systems Management International
Chris Nodder	National Westminster Bank
Ian Maclelland and Bronwen Taylor	Philips Corporate Design
Fiona Maclennan	PA Consulting
Iain Macleod and Richard Scaif	Aerosystems International
Martin Rantzer	Ericsson Radio Systems
Nick Rousseau and Ian Franklin	Employment Service
Petri Salminen	GEMIST
Samuli Saukkonen and Kari Kuutti	University of Oulu
Professor Brian Shackel and Martin Maguire	HUSAT
Brian Sherwood-Jones, David Carr and Phil Miller	BAe SEMA
Robert Taylor and Simon Finnie	DERA
Ralph Thompson and Nick Ryan	Inland Revenue
Christine Tomlinson	Lloyd's Register
Colin Tully	Collin Tully Associates
Paul Wilson	CSC

Annex 10: List of Revisions

version	date	by	changes made	file
0.1	24/9/97	JVE	First draft of document including SPICE Part 2 and 5 sections for drafting purposes. Including HCD process definitions and base practices from old UMM. Including new HC-ness scale attributes and indicators from UMM base practices. Users and How to Use sections. Some refinement of practices.	D514_a D514_b
0.2	30/9- 22/10/97	JVE	Revisions following review workshop. HC scale removed. HCD practices refined. About and Introduction sections elaborated. Work products refined. Mappings to more difficult standards removed. Annexes revised. Addition of recording form	D514p_c
1.0	16-30 /1/98 27/2/98	JVE	Editorial and technical revisions following review. Addition of mappings to CMM and SE-CMM. Addition of list of contributors. Revision of HCD.1, 2 &3 to take Philips model into account. Work products refined. Advice added to recording form. Illustrations refined, addition of executive summary.	D514p_1 D514p_1a
1.1	23/3/98	JVE	Addition of copyright note on each page. Correction of 'Elements of the model and 'UMM structure' figures. Correction of title of HCD 1.1	D514p_1b
2.0	04/11/98	JVE	Removal of INUSE logo from front page. Replacement of INUSE with TRUMP on page header. Replacement of HCD process section and Annex 2 with revised processes and work products from WG6 NWI version. Revision of summary, Figure 1, mappings and recording sheet to accord with the WG6 NWI version.	TR_UMP _A.doc
2.1	26/11/98	JVE	Revision of HCD 6.6.1 - 6.6.3 for clarity.	TR_UMP _b.doc
2.2	19/08/99	JVE	Update of introduction, processes and work products to take account of changes by WG6 up to this date. Addition of reference to ISO TR and addition to Abstract	TR_UMP _c.doc