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# **Usability Maturity Model: Human Centredness Scale**

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## **Abstract**

An organisational human-centredness maturity scale based on Flanagan's Usability Leadership scale, Sherwood-Jones' Total System maturity model and ISO 13407. The background to the scale is described. The scale has six levels defined by a set of attributes. Each attribute is defined by one or more management practices performed at that level. The management practices are defined. The uses of the scale are outlined. A recording form is supplied and its use described. Some indicators of personal attitude at each level are given. The scale is conformant to ISO 15504. This version specially prepared for the TRUMP project

**Keywords: human-centred, maturity, software process improvement, capability, usability**

## Executive summary

This document is intended to assist those who wish to make their organisation more human-centred. It presents an ordered scale of maturity with respect to human-centredness. The scale is derived from all significant, existing models. The scale combines attitude, technology and management activities into six steps towards a fully human-centred approach. The document lists the components of these steps as a checklist of practices. The checklist is intended for use in the assessment of the human-centredness of an organisation or department. The scale can also be used as a simple model for organisational design and process improvement

The Human-centredness Scale is intended mainly for use by HF consultants as a basis for early discussions with client organisations or projects. It offers a model of how organisations progress through levels of understanding of human-centred issues. Measuring an organisation's level on this scale provides information with which to plan the improvement of human-centred processes. The levels of maturity of the client will indicate what terms to use in discussing user issues and what methods and tools the client will be able to accept, understand and use.

The increasing levels of maturity of human-centred processes are listed below. The document elaborates these levels and provides a tool for structured assessment of the level reached by an organisation:

<b>Level:</b>	<b>Attribute:</b>
<b>Unrecognised</b>	(no indicators)
<b>Recognised</b>	Problem recognition Performed processes
<b>Considered</b>	Quality in use awareness User focus
<b>Implemented</b>	User involvement Human factors technology Human factors skills
<b>Integrated</b>	Integration Improvement Iteration
<b>Institutionalised</b>	Human-centred leadership Organisational human-centredness

The document describes the use of the scale. One use is for 'stand-alone' maturity assessments of client organisations by internal or external consultants. These assessments can vary in the degree of formality employed. The scale can be used for assessments with processes from other models. The attributes from the Human-centredness Scale can be added to other maturity scales. Use in organisation and process improvement is described.

**Changes**

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1.0	Approved version	J Earthy	D514s_1a.doc
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**Approval**

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## TABLE OF CONTENTS

<b>ABOUT THIS DOCUMENT</b>	<b>6</b>
Scope	6
Overview	6
How to Use the Document	6
Maintenance	7
Glossary of terms	7
<b>INTRODUCTION</b>	<b>8</b>
Benefits of Human-Centredness in the Lifecycle	8
Rationale for the Scale	8
Basis of the Scale	9
ISO 15504 for Maturity Models	9
<b>THE ORGANISATIONAL HUMAN-CENTREDNESS SCALE</b>	<b>10</b>
Levels of Human-Centredness	10
Transition between Levels	11
Description of Levels	13
<b>USE OF THE MODEL</b>	<b>20</b>
Human-Centredness Scale	20
Human-Centred Scale plus other Models	21
Use of the Scale outside Assessment	22
<b>REFERENCES</b>	<b>23</b>
<b>ANNEX 1: IMPACT ON STAKEHOLDERS</b>	<b>24</b>
<b>ANNEX 2: STATEMENT OF CONFORMANCE TO ISO 15504</b>	<b>25</b>
7.2 Model purpose	25
7.3 Model scope	25
7.4 Model elements and indicators	25

<b>7.5 Mapping</b>	<b>26</b>
<b>7.6 Translation</b>	<b>26</b>
<b>ANNEX 3: SAMPLE RECORDING FORM</b>	<b>28</b>
Use of the recording form	28
Recording form	29
<b>ANNEX 4: ATTRIBUTE INDICATORS: TYPICAL QUOTES</b>	<b>32</b>
Level X Unrecognised	32
Level A Recognised	32
Level B Considered	32
Level C Implemented	32
Level D Integrated	33
Level E Institutionalised	33
<b>ANNEX 5: DOCUMENT CONTROL</b>	<b>34</b>

## About this document

This document provides a simple model for, and explains the method by which to assess, the level of maturity reached by an organisation in its capability to do human-centred design. The level of maturity is assigned to one of six levels on a Maturity Scale. Each level is defined in terms of the management activities demonstrated by an organisation at that level.

### Scope

This document contains a maturity scale for the assessment of an organisation's progress towards human-centredness in system development and operation.

The Human-centredness Scale is intended for use as a basis for early discussions with client organisations or projects. It provides a reference model of how organisations progress through levels of understanding of human-centred issues. Ascertaining the level of a client on this scale gives an advisor or consultant useful information for the improvement of the client's human-centred processes. The level of maturity of the client will indicate what terms to use in discussing user issues and what methods and tools the client will be able to accept, understand and use.

### 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 presented model and describes its elements.

The Human-centredness Scale describes six sets of processes, technology and attitude indicators which define levels of organisational maturity towards human-centredness. This scale can be used to assess the degree of maturity of the organisation towards a human centred approach.

The Use of the Scale is the final section of the main document. It contains guidance on the uses which can be made of the scale.

Annex 1 reviews the potential users of the document. Annex 2 is a statement of conformance to ISO 15504. Annexes 3&4 provide advice and materials for assessors using the model. Annex 5 records revisions to the document.

### How to Use the Document

This section lists the recommended sequences for studying this document for the main groups of readers. The groups which may be affected by the scale and its use are described in Annex 1 which should be studied by all readers:

1. **Human Factors and Human Computer Interaction advisors/consultants.** These readers should study the Overview and the Introduction. The Human-centredness Scale should be familiar. The issues of measurement in the section Use of the Model should be studied.
2. **Process Improvement Consultants and Business Process Engineers.** These readers should study the Introduction in detail, taking special account of the earlier sections which

describe the human-centred approach. The Human-centredness Scale describes what changes in awareness are required in the organisation in order for it to be user- and human-centred in its approach to its systems and services.

3. **Processes Assessors and Developers of Maturity Models.** The scale follows ISO 15504, SPICE. Readers should study the overview to see how the scale is constructed. The early parts of the Introduction explain why the model has been constructed and what it contains. The section on the Human-centredness Scale contains the technical section of the model.

## 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 (EUSCs) and the Human-Centred Process Improvement Group (HCPIG) 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:

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## 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.

**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 of a process or enhances the capability of a process.

**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.

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

**system** The term *system* is used to describe a *product* or *service*, implemented in any combination of physical equipment, computer software, documentation, 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.

**user** Anyone who employs an artefact or system to achieve a task. (Also **end user**)

## Introduction

### Benefits of Human-Centredness in the Lifecycle

This document is intended to assist those who wish to make their organisation more Human-centred. It presents an ordered scale which combines attitude, technology and management practices which comprise steps towards a fully human-centred approach and lists their components in a checklist which can be used for assessment of the human-centredness of an organisation or department.

The benefits of human-centredness in the lifecycle are described in ISO 13407 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.’*

This standard 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 Scale

This scale 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 scale is also intended to assist those who wish to improve their organisation’s performance of human-centred activities. It is intended that the scale is used early in projects or process improvement activities.

The scale has not been developed as part of one of the existing process models, such as the System Engineering Capability Maturity Model or ISO 15504 Software Process Assessment. This is in order to make clear the nature of organisational maturity with regard to human-centredness and its implications for system maturity modelling.

The scale uses the existence of Management Practices to assess the degree to which the organisation has a human-centred approach to its work and working culture. In doing this it could be said to assess organisational attitude to human-centredness. The most common approach to the assessment of personal attitude does not use performance of practice as the measure. However, in the case of this model the desirable measurement is not personal attitude to end-users, but the degree to which the organisation implements practices which make its processes human-centred

## Basis of the Scale

The scale is based on a number of models including Flanagan's Usability Leadership Maturity Model (1995), Sherwood-Jones' Total Systems Maturity Model (1995) and ISO 13407 human-centred Design Processes for Interactive Systems.

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 scale presented in this document measures progress towards the particular goal of human-centredness, rather than the usual overall quality goal used by software process improvement models.

This scale is intended to measure how human-centred an organisation or department is in its systems development and support activities. Whilst the majority of the attributes for the scale are management practices some attributes are staff or management attitudes or technical capabilities.

## ISO 15504 for Maturity Models

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

# The Organisational Human-Centredness Scale

## Levels of Human-Centredness

The main steps in increasing the maturity of human-centred processes are listed in Table 1 below. These steps reflect the progression of concerns and practices observed in organisations which adopt a human-centred approach to systems development and management.

The level of human-centredness of an organisation provides information about how best to communicate with an organisation about human-centred issues. An organisation with a low rating is unlikely to be able to conceive of the processes necessary to bring about the highest levels of maturity. However, they will be able to understand the benefits of the next level of maturity and will be able to see how to extend what they do now in order to improve or move up a level.

The existence of levels of maturity with regard to human-centredness explains why human-centred methods developed for organisations with high levels of maturity cannot be adopted by organisations at a lower level of maturity. The supporting processes and information flows necessary to make the method work do not exist and the attitude necessary to put them in place is not widespread enough to make a difference.

**Table 1 Maturity Levels and Process Attributes**

ID	Title
<b>Level X</b>	<b>Unrecognised</b>
	(no indicators)
<b>Level A</b>	<b>Recognised</b>
A1	Problem recognition attribute
A2	Performed processes attribute
<b>Level B</b>	<b>Considered</b>
B.1	Quality in use awareness attribute
B.2	User focus attribute
<b>Level C</b>	<b>Implemented</b>
C.1	User involvement attribute
C.2	Human factors technology attribute
C.3	Human factors skills attribute
<b>Level D</b>	<b>Integrated</b>
D.1	Integration attribute
D.2	Improvement attribute
D.3	Iteration attribute
<b>Level E</b>	<b>Institutionalised</b>
E.1	Human-centred leadership attribute
E.2	Organisational human-centredness attribute

## Transition between Levels

The following sections describe each of the levels in terms of the level of maturity of processes, but the most significant aspect is that of the culture within the development team, and this is discussed here.

Moving from level A (recognised) to level B (considered) is a major cultural change, from a craft-like traditional engineering outlook based on experience, to a systems approach. Usability, reliability, safety and all the other non-functional aspects become formal disciplines and do not rely on "good practice" or "engineering judgement". At level A design and support teams may still be actively hostile to users who don't know how to use their elegant creation. At level B these teams have changed and are aware that systems are made to be used by people.

Moving from B (considered) to C (implemented) is a major cultural change in a traditional systems development environment; users get thought about rather than cursed or ignored. Engineers recognise that analysts are not the same as the end users, and that what will work for the user is not necessarily what seems obvious to a technical specialist.

Moving from C (implemented) to D (integrated) requires routine use of human factors expertise and human-centred methods and tools. The user is given formal recognition, and associated development processes are regarded as mainstream rather than something done by specialists for marketing or political purposes (and largely ignored).

Moving from D (integrated) to E (institutionalised) requires that the systems development culture is embedded in a business (and/or safety) driven multi-disciplinary culture. The cultural and business focus is on what the customer organisation will be able to do, rather than the functionality of any supporting hardware/software.

Table 2 shows how fully each attribute should be realised in order for the level to be achieved.

**Table 2 Maturity Level Ratings**

<b>Scale</b>	<b>Process Attributes</b>	<b>Rating</b>
<b>Level A</b>	Problem recognition	fully or largely
	Performed processes	fully or largely
<b>Level B</b>	Problem recognition	fully
	Performed processes	fully
	Quality in use awareness	fully or largely
	User focus	fully or largely
<b>Level C</b>	Problem recognition	fully
	Performed processes	fully
	Quality in use awareness	fully
	User focus	fully
	User involvement	fully or largely
	HF technology	fully or largely
	HF skills	fully or largely
<b>Level D</b>	Problem recognition	fully
	Performed processes	fully
	Quality in use awareness	fully
	User focus	fully
	User involvement	fully
	HF technology	fully
	HF skills	fully
	Integration	fully or largely
	Improvement	fully or largely
	Iteration	fully or largely
<b>Level E</b>	Problem recognition	fully
	Performed processes	fully
	Quality in use awareness	fully
	User focus	fully
	User involvement	fully
	HF technology	fully
	HF skills	fully
	Integration	fully
	Improvement	fully
	Iteration	fully
	Human-centred leadership	fully or largely
	Organisational Human-centredness	fully or largely

## Description of Levels

The following sections describe the management practices and the technical and attitude changes which typify each level of maturity.

### Level X: Unrecognised

The need for a human-centred process is not recognised. If systems are received with varying degrees of satisfaction by their end users this does not cause concern. There are no positive human-centred attributes at this level.

### Level A: Recognised

The organisation recognises that there is a need to improve the quality in use of its systems. The organisation has a development process and produces systems. Members of the organisation understand the business benefit of producing usable products.

#### A.1 Problem recognition attribute.

The extent to which members of the organisation understand that there is a problem with the quality in use of the systems produced.

- in order to achieve this level of maturity an organisation should carry out the following:

ID	Management practices
A1.1	Problem recognition. Management and staff are aware that there is a need to improve aspects of the systems under development concerned with their use.

#### A.2 Performed processes attribute<sup>i</sup>.

The extent to which processes are performed that provide input that could be used to make the system human-centred.

- in order to achieve this level of maturity an organisation should carry out the following:

ID	Management practices
A2.1	Information collection. Information is collected which could be used to take account of user requirements.
A2.2	Performance of relevant practices. Practices are performed which could be used to include information about user requirements in the system or service.

<sup>i</sup> These practices are not strictly human-centred. However, the sources of information and existence of relevant development practices are necessary requirements for user-centred development and will be required at all higher levels of maturity.

**Level B: Considered**

The organisation makes its staff aware that quality in use is an important attribute of its products and it engages in awareness raising and training to make its staff aware that quality in use can be improved by taking account of end-user requirements during development of the product.

The following attributes of the process demonstrate the achievement of this level, in addition to the attributes for the previous level:

**B.1 Quality in use awareness attribute.**

The extent to which the staff carrying out a process are aware of quality in use as an attribute of the system.

- in order to achieve this level of maturity an organisation should carry out the following:

ID	Management practices
B1.1	Quality in use training. Staff are made aware that quality in use is a particular attribute of a system which can be improved.
B1.2	Human-centred methods training. Staff are made aware that quality in use is achieved through the use of a series of human-centred processes during the development and support/use of a system.
B1.3	Human-system interaction training. Staff are made aware that human-centredness covers the total system, not just the user interface or the physical ergonomics.

**B.2 User focus attribute.**

The extent to which staff performing processes relating to the user-facing elements of the system take account of the fact that a human being will need to use it.

- in order to achieve this level of maturity an organisation should carry out the following:

ID	Management practices
B2.1	User consideration training. Staff are made aware that the needs of the end users of the system should be considered when developing or supporting the system.
B2.2	Context of use training. Staff are made aware that end users' skills, background and motivation may differ from developers or system support staff.

**Level C: Implemented**

Human-centred processes are fully implemented and produce good results. End-users or suitable representatives are involved in specifying and testing systems. Suitably trained staff are available as required to perform the processes which take account of user issues. Techniques are employed which are appropriate to the system, stage in the development and the end users.

The following attributes of the process demonstrate the achievement of this level, in addition to the attributes for all the previous levels:

**C.1 User involvement attribute.**

The extent to which information is elicited from representative users using appropriate techniques throughout the lifecycle. .

- in order to achieve this level of maturity an organisation should carry out the following:

ID	Management practices
C.1.1	Active involvement of users. The development process ensures understanding of user needs through user involvement in all development phases.
C.1.2	Elicitation of user experience. The design solution is shown to stakeholders and they are allowed to perform tasks (or simulated tasks).
C.1.3	End users define quality-in-use. Systems are tested using measures of quality in use derived from end users.
C.1.4	Continuous evaluation. Early and continual testing is an essential element of the development methodology. The process is based on the necessity for feedback from users.

**C.2 HF technology attribute.**

The extent to which human factors methods and techniques are used in or by human-centred processes.

- in order to achieve this level of maturity an organisation should carry out the following:

ID	Management practices
C.2.1	Provide appropriate human-centred methods. Select and support methods for the elicitation of user input at all stages in the lifecycle.
C.2.2	Provide suitable facilities and tools. Suitable facilities and tools are provided for quality in use activities.
C.2.3	Maintain quality in use techniques. Ensure that methods and techniques are reviewed for suitability and that state-of-the-art user interface technologies are used as appropriate in developing new systems.

**C.3 HF skills attribute.**

The extent to which human factors skills are used in human-centred processes.

- in order to achieve this level of maturity an organisation should carry out the following:

<b>ID</b>	<b>Management practices</b>
<b>C.3.1</b>	Decide on required skills. Identify required competencies and plan how to make these available in order to facilitate multi-disciplinary design solutions.
<b>C.3.2</b>	Develop appropriate skills. Development of appropriate skills in human-centred staff either by training or by job experience.
<b>C.3.3</b>	Deploy appropriate staff. Skilled staff are involved and effective in all stages of development as and when required.

**Level D: Integrated**

Human-centred processes are integrated into the quality process and systems lifecycle of the organisation. The systems and human-centred lifecycles are managed to ensure that the results of the human-centred processes produce improvements in all relevant work products. The required time and resources are provided for revision to improve quality in use. Information derived from human-centred processes is in a suitable format to be easily assimilated by relevant staff.

The following attributes of the process demonstrate the achievement of this level, in addition to the attributes for all the previous levels:

**D.1 Integration attribute.**

The extent to which Human-centred processes are integrated with other processes.

- in order to achieve this level of maturity an organisation should carry out the following:

ID	Management practices
D.1.1	Integrate HF processes. Integration of quality in use processes with quality system.
D.1.2	Facilitate interface between HF and the organisation. Ensure that the department promoting a human-centred approach understands and uses the language and working methods appropriate to successful interaction with other departments.
D.1.3	Use appropriate representations. Representations of user requirements and changes to the system arising from user involvement should be understandable by system developers and programmers.

**D.2 Improvement attribute.**

The extent to which Human-centred processes are used in the improvement of work products from other processes.

- in order to achieve this level of maturity an organisation should carry out the following:

ID	Management practices
D2.1	Ensure design feedback. Ensure that evaluations take place at all stages in order to influence the system to be delivered.
D2.2	Change based on feedback. The development process encourages design changes based on actual user experience.
D2.3	Timing of feedback. Ensure that information on user needs and quality in use defects is fed into the design process at appropriate times and in the right format for use.

**D.3 Iteration attribute.**

The extent to which the development lifecycle is iterative.

- in order to achieve this level of maturity an organisation should carry out the following:

ID	Management practices
D.3.1	Minimize risks by iteration of design. Iteration of the design using prototypes etc. increases the match between the final system and user expectations
D.3.2	Manage iteration of design solutions. Information should be recorded to manage the progress of iterative design.
D.3.3	Use design objectives to control iteration. Manage the prototyping process by setting and

	monitoring target quality in use levels set for particular aspects of the system.
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**Level E: Institutionalised**

The quality in use of whole ranges of systems is coordinated and managed for business benefit. The culture of the organisation gains benefit from being user and human centred. Human-centred processes are used within the organisation to improve the quality in use of the processes, tools and methods used and developed by the organisation for its own use. Quality in use defects are treated on equal terms with other system defects. Human-centred skills are regarded on a par with engineering skills.

The following attributes of the process demonstrate the achievement of this level, in addition to the attributes for all the previous levels:

**E.1 Human-centred leadership attribute.**

The extent to which the human factors/people-centred approach influences the management of all systems lifecycle processes.

- in order to achieve this level of maturity an organisation should carry out the following:

ID	Management practices
E1.1	Manage usability programme. Management of the whole programme of human-centred processes on all projects in a department or organisation.
E1.2	Systematic improvement of quality in use. Use quality in use defects to analyse and improve problems with the organisation’s processes, thereby reducing quality in use defects.
E1.3	Human-centred improvement of organisation. The approaches used to ensure that systems are human-centred are also used within the organisation to improve its own processes and systems.

**E.2 Organisational human-centredness attribute.**

The extent to which the human factors/people-centred approach influences the attitude of the organisation.

- in order to achieve this level of maturity an organisation should carry out the following:

ID	Management practices
E2.1	Organisational implementation of user-centred practices. Assist the organisation in the establishment and use of human-centred tools and methods, and in maintaining a focus on the consideration of user issues.
E2.2	Acceptance of human-centred skills. Recognition of the pivotal role played by human-centred skills in an integrated development team. Management of the resources available - human and others.

## Use of the Model

The scale contained in this document is intended for use in the assessment and improvement of how mature an organisation is with respect to its attitude to and performance of human-centred activities in system development and system management.

The following sections describe the primary uses of the scale.

### Human-Centredness Scale

The scale is mainly intended for use in a 'stand-alone' mode. In this mode the assessor will usually be a human factors consultant or a member of an organisation's staff charged with determining and improving an organisation's level of capability in human factors, or with improving the quality in use of an organisation's products.

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.

The first step is to establish how aware/mature/capable the organisation is with respect to human-centredness of systems.

This is achieved by interviewing selected staff in order to ascertain how widely human-centred management practices, tools and attitudes are in place. The scale presented in the preceding section provides a reference model for use in these interviews and Annex 3 provides a recording form for the assessment.

In general, interviews with the head of the systems development group and a project manager will be sufficient to give a reasonable impression of the level of maturity. For reasons of anonymity, and so as to attain a meaningful and representative measure, more than one project should be assessed, the precise number depending on the size of the organisation. On occasions where the performance of the intended practices and attitudes is not clear a supplementary interview with project staff may be necessary.

The duration of the interviews should not be more than an hour each. It is advisable to begin the interview and set the context by asking the interviewee to review the organisation's systems development and support processes as typified by a recent project. During the review listen for the way users and other stakeholders are referred to and try to match it to the typical quotes in Annex 4 of this document.

After this review use the management practice descriptions in the Scale to lead the discussion towards the particular issues which exemplify human-centred practice. It is advisable to start by asking questions about the lowest levels of maturity and move up the scale until it is obvious that the practices are not being achieved. Do not go beyond this level.

Use the form provided in Annex 1 to record your findings. Rate each practice for each interviewee on a scale of N to F where:

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

Give the benefit of the doubt when allocating ratings. In some cases the interviewee will divide their answer into “I want to do this” and “the staff currently do that”. In these cases use two columns of the Annex 3 recording form to record the difference levels of achievement.

Use the form in Annex 3 to calculate the overall rating of 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 (see below). The first section of Annex 3 describes the sequence of actions required to use the recording form. The more practised the interviewer becomes the less mechanical the use of the form will be.

## **Human-Centred Scale plus other Models**

The scale presented in this document can be use in association with other models. There are two main alternatives. These are described below.

### **Human-centredness Scale plus processes**

There are a number of models of systems development processes. These consist of a series of descriptions of the processes necessary to specify, develop and operate a system of some sort (e.g. software, telecommunications, military, organisation etc.). These descriptions are often hierarchical. In order to assess how well the processes are being carried out by a particular organisation or department, a process maturity assessment is performed. Such assessments are generally carried out on the project level and assess how well the component tasks or practices of a process are performed. The overall performance of the process in terms of maturity is determined on the basis of how well particular processes concerned with the management of the process are carried out.

The Human-centredness Scale can be used as part of a process maturity assessment. When the maturity of the management processes is being assessed, the maturity of the human-centred aspects of the process against the scale given in this document can also be enquired about. The report of process capability can then be extended with the extra dimension of human-centredness as assessed using this scale.

### **Human-centredness Scale attributes in another scale**

The attributes given in the Human-centredness Scale are described in such a way that they can be added to other maturity assessment scales (such as the ISO 15504 capability scale). When performing an assessment using a capability maturity model the assessment team may find that the scale is not sufficiently precise in dealing with issues relating to human-centredness. For example, when assessing the development of highly interactive software for public use or safety related systems. In these cases the factors which contribute to usability could be addressed more securely by adding (for instance) attributes relating to user involvement and iteration to the capability scale. The assessment would still report capability but the scale would have added sensitivity to the particular management issues related to human-centredness.

The assessment tool in use would be extended with the attributes, practices and indicators from this document. Their suggested location in the capability scale is indicated in the mapping given in the conformance statement in Annex 2. It should be noted that the scales are not intended to measure the same thing and the mapping is subject to some interpretation.

The best approach in selecting practices for use in another scale is to take each practice on its own terms for what it measures, rather than try to force a one to one mapping between steps towards human-centredness and steps towards the goal of the recipient scale.

## **Use of the Scale outside Assessment**

### **Use of the Scale in organisational design**

The Human-centredness Scale can be used as a simple model of how to operate an organisation in a human-centred manner. The management practices can be used as descriptions of what is required in order to achieve human-centredness from an attitude and management point of view. These descriptions should be taken into account when re-engineering departments or organisations to achieve business goals when business goals include meeting user's requirements.

### **Use of the Scale in process improvement**

The Human-centredness Scale provides descriptions of how organisations take account of user issues at a number of levels of maturity with regard to human-centredness. These descriptions can be used in setting the agenda and goals for improvement of technical and/or business processes. 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.

### **Use of the Scale in informal assessment**

The assessment approach described above is reasonably 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 scale can also be used in a more informal setting, such as a workshop or discussion group. The presentation of the operation of the department 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, then the assessment as to whether management practices are performed or not would become a group decision. The result need not be recorded, but a general agreement about the achieved level, the required level for the business or project, and the actions required to attain that level should be achieved.

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## Annex 1: Impact on Stakeholders

Those affected by the scale 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 of users require a simple tool for diagnosis of problems/level of maturity in client organisations. They will be familiar with human-centred design but not so familiar with process improvement.
2. **Process Improvement Consultants.** This group of users require 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.
3. **Business process engineers.** This group may wish to take account of human-centred design issues in the systems or services of a client organisation. Business process engineers may not be familiar with the level of detail in process models. This group will require more background information and justification. The expected benefits of a human-centred approach will be paramount.
4. **Process Assessors.** This group requires rigorous tools to support the measurement of maturity. They will be very familiar with process modelling and assessment but are unlikely to be familiar with human-centred approaches. They are likely to be hostile to the concept of alternative maturity scales and are unlikely to use the Human-centredness Scale voluntarily.
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 indicators which can be extracted and combined into assessment tools and/or other scales. 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 also be taken into account by those using this document:

1. **Managers of projects which are assessed against the scale.** This group should be involved in the preparation for assessments and will probably be interviewees during assessment. 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 the assessment. Process interface issues should be their first concern.
2. **Managers and staff of departments and/or projects which are the subject of human-centred process improvement exercises.** As for assessment (see above point), 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: Statement of Conformance to ISO 15504**

ISO TR 15504 places conformance requirements on capability models. The following sections quote these requirements 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.”*

This model is designed to assess system process capability. The model is designed to include software for cases where systems include software.

### **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.*

*A model shall address all or a continuous subset of the levels (starting at level 1) of the capability dimension of the reference model contained in this part of the Technical Report for all of the processes within its scope.*

*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 is designed to address all levels of human-centredness for all processes in any process model at any level of capability. The model does not contain any processes. The model presents a set of management practices which may be mapped into the 15504 capability scale.

### **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 model does not contain any processes. There are therefore no process indicators.

*“In the capability dimension, the detailed elements shall constitute a set of indicators of process capability that focus attention on the process management practices that realise the process attributes.”*

The management practices and typical quotes comprise the indicators for the attributes of the levels given in the scale.

## 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 capability dimension, the mapping shall include the mapping of the indicators of process capability indicators within the model to the definitions of the process attributes in the reference model”*

A sample mapping between the human-centredness scale and the 15504 quality management capability scale is given in table 3 below. The differences between the level assigned to some activities in the two scales can largely be explained by the focus on organisational appreciation of a particular product attribute in the Human-centredness Scale and the resulting possibility of selective improvement of that attribute.

**Table 3. Mapping between the Organisational Human-Centredness Scale and the 15504 Capability Maturity Scale**

ID	15504 Scale Title	Human-centredness Scale Practices
Level 0	Not Performed	<b>A1.1, B1.1, B1.2, B1.3, B2.1, B2.2, E2.2</b>
Level 1	Performed Process	
1.1	<b>Process performance attribute</b>	<b>A2.1, A2.2, C1.1, C1.2</b>
Level 2	Managed Process	
2.1	<b>Performance management attribute</b>	<b>E1.1</b>
2.2	<b>Work product management attribute</b>	<b>C1.3, C1.4, D1.3</b>
Level 3	Established Process	
3.1	<b>Process definition attribute</b>	<b>C2.3, D1.1, D1.2, D2.1, D2.2, D2.3, D3.1, E2.1</b>
3.2	<b>Process resource attribute</b>	<b>C2.1, C2.2, C3.1, C3.2, C3.3</b>
Level 4	Predictable Process	
4.1	<b>Process measurement attribute</b>	<b>D3.2</b>
4.2	<b>Process control attribute</b>	<b>D3.3</b>
Level 5	Optimizing Process	
5.1	<b>Process change attribute</b>	<b>E1.2</b>
5.2	<b>Continuous improvement attribute</b>	<b>E1.3</b>

## 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.”*

Since human-centredness is not necessarily identical to quality management as an organisational goal the scale used for the assessment of human-centredness need not map onto the process attribute ratings of ISO 15504. However, when process attributes are taken from

this scale and used as elements of an enhanced capability scale the developer of such a scale is required to provide a translation process conforming to this requirement.

## Annex 3: Sample Recording Form

### Use of the recording form

#### Index of fields:

<b>attribute number</b>	<b>attribute name</b>	<i>1 (use this column for the first interview)</i>	<i>2 (use this column for a second interview)</i>	<i>3 (use this column for a third interview)</i>	<b>rating</b>
<b>practice number</b>	practice name	<i>data entry field 1.1</i>	<i>data entry field 2.1</i>	<i>data entry field 3.1</i>	
<b>-do-</b>	-do-	<i>data entry field 1.n</i>	<i>data entry field 2.n</i>	<i>data entry field 3.n</i>	
	<b>Combined rating for attribute (A1.1 to 1.3):</b>	<i>combined ratings for this column here</i>	<i>combined ratings for this column here</i>	<i>combined ratings for this column here</i>	<i>record the combination of this row here</i>
	<b>Combination of ratings for this level:</b>				<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 column for each interview. Note: it is rare to hold more than two interviews.
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

### Level A Recognised

A.1	Problem recognition attribute	1 <sup>ii</sup>	2	3	rating <sup>iii</sup>
A1.1	Problem recognition				
	<b>Combined rating for attribute (A1.1):</b>				
A.2	<b>Performed processes attribute</b>				
A2.1	Information collection				
A2.2	Performance of relevant practices				
	<b>Combined rating for attribute (A2.1 to 2.2):</b>				
	<b>Combination of ratings for this level:</b>				

### Level B Considered

B.1	Quality in use awareness attribute	1	2	3	rating
B1.1	Quality in use training				
B1.2	Human-centred methods training				
B1.3	Human-system interaction training				
	<b>Combined rating for attribute (B1.1&amp;1.3):</b>				
B.2	<b>User focus attribute</b>				
B2.1	User consideration training				
B2.2	Context of use training				
	<b>Combined rating for attribute (B2.1&amp;2.2):</b>				
	<b>Combination of ratings for this level:</b>				

<sup>ii</sup> Rate each interviewee’s response. Use one of: Never, Partially, Largely or Fully

<sup>iii</sup> Average of responses for interviewees 1 to 3. If value is between ratings take the higher rating.

**Level C Implemented**

<b>C.1</b>	<b>User involvement attribute</b>	1	2	3	rating
<b>C.1.1</b>	Active involvement of users				
<b>C.1.2</b>	Elicitation of user experience				
<b>C.1.3</b>	End users define quality-in-use				
<b>C.1.4</b>	Continuous evaluation				
	<b>Combined rating for attribute (C 1.1 to 1.4):</b>				
<b>C.2</b>	<b>HF technology attribute</b>				
<b>C.2.1</b>	Provide appropriate human-centred methods				
<b>C.2.2</b>	Provide suitable facilities and tools				
<b>C.2.3</b>	Maintain quality in use techniques				
	<b>Combined rating for attribute (C2.1 to 2.3):</b>				
<b>C.3</b>	<b>HF skills attribute</b>				
<b>C.3.1</b>	Decide on required skills				
<b>C.3.2</b>	Develop appropriate skills				
<b>C.3.3</b>	Deploy appropriate staff				
	<b>Combined rating for attribute (C3.1 to 3.3):</b>				
	<b>Combination of ratings for this level:</b>				

**Level D Integrated**

<b>D.1</b>	<b>Integration attribute</b>	1	2	3	rating
<b>D.1.1</b>	Integrate HF processes				
<b>D.1.2</b>	Facilitate interface between HF and the organisation				
<b>D.1.3</b>	Use appropriate representations				
	<b>Combined rating for attribute (D1.1 to 1.3):</b>				
<b>D.2</b>	<b>Improvement attribute</b>				
<b>D2.1</b>	Ensure design feedback				
<b>D2.2</b>	Change based on feedback				
<b>D2.3</b>	Timing of feedback				
	<b>Combined rating for attribute(D2.1 to 2.3):</b>				
<b>D.3</b>	<b>Iteration attribute</b>				
<b>D.3.1</b>	Minimize risks by iteration of design				
<b>D.3.2</b>	Manage iteration of design solutions				
<b>D.3.3</b>	Use design objectives to control iteration				
	<b>Combined rating for attribute (D3.1 to 3.3):</b>				
	<b>Combination of ratings for this level:</b>				

**Level E Institutionalised**

<b>E.1</b>	<b>Human-centred leadership attribute</b>	1	2	3	rating
<b>E1.1</b>	Manage usability programme				
<b>E1.2</b>	Systematic improvement in quality in use				
<b>E1.3</b>	Human-centred improvement of organisation				
	<b>Combined rating for attribute (E1.1 to 1.3):</b>				
<b>E.2</b>	<b>Organisational human-centredness attribute</b>				
<b>E2.1</b>	Organisational implementation of user-centred practices				
<b>E2.2</b>	Acceptance of human-centred skills				
	<b>Combined rating for attribute (E2.1 to 2.2):</b>				
	<b>Combination of ratings for this level:</b>				

## Annex 4: Attribute Indicators: Typical Quotes

This annex provides an example which extends the ‘pictures’ of life at each level of maturity described in the Introduction. The examples are taken from one particular area where a wide range of levels of maturity to human-centredness is experienced - the area of software usability. Readers should not have too much difficulty extrapolating to their own area of experience in systems engineering.

Each section provides a paraphrase of the management attitude quote from Crosby’s original Quality Maturity Grid and a series of ‘Typical Quotes’ from project management and staff in organisations working at each level of maturity in software development organisations. The majority of the quotes (and all up to and including level C) are real.

### Level X Unrecognised

**Ignorance** *“We don’t have problems with usability”.*  
(Usability is not discussed as an issue)

### Level A Recognised

**Uncertainty** *“We don’t know why we have problems with usability.”* (pace Crosby, level I)

Six users twelve opinions

It works better than what they’ve got now

This is how we did it last time

That’s not our problem, it’s not in the statement of work

That’s a training problem

Nobody’s complained before

How can you find out what they want? We have not built it for them yet

### Level B Considered

**Awakening** *“Is it absolutely necessary to always have problems with usability?”* (pace Crosby, level II)

It’s just a database query so no HF is needed

It uses COTS so usability is not an issue

We’ve used a GUI so it must be user-friendly

I’ve just designed this great HCI

It may not be intuitive at first but give it time

It’s usable, I copied the Help look and feel exactly

Write me a proposal for ways of fixing the usability problems in less than 20 days

It’s new, they won’t be able to understand how it will affect them

I don’t want you talking to the client again

### Level C Implemented

**Enlightenment** *“Through management commitment and improvement of human-centred processes we are identifying and resolving our problems.”* (pace Crosby, level III)

It’s too late to consider that

What you [users] want is for all the menus to look like this one

What do you mean it isn’t usable?

Perhaps there will have to be some training  
 I want a 99% correct prototype  
 I don't want the programmers to stop work while you sort this out  
 We can't just revise the requirements forever  
 A programmer will demonstrate the system in the user trial  
 We've nearly finished the first phase of implementation, it's time for the user trial  
 This is OK isn't it? [to users or HF staff]  
 We have the standards somewhere  
 We don't want the requirements to constrain the designers too much  
 The scope is signed off, that's all I care about  
 You've been causing trouble again  
 I am giving the training course to the users next week. I have no idea what background they have got.

### **Level D Integrated**

**Wisdom** *"Usability defect prevention is a routine part of our operation."* (pace Crosby, level IV)

Obviously we can't do the HCI design until we've done the task analysis  
 The user feedback told us....  
 Well, we'll just have to see how it does in the user trials  
 We will have to postpone the next trial, we have not implemented the changes from the last one yet  
 Thanks for the change request for the focus group work instruction.  
 Can we user trial the documentation?  
 How many users shall I get you from each stakeholder group?  
 We will supply a range of demonstrators for the requirements workshop  
 Is one field survey a year often enough?  
 Can my trainers hand out usability questionnaires?  
 Thanks for help with the human impact study, see you at the project start-up meeting.  
 The usability test results are OK, ship the system  
 We have another meeting with the client's CEO to discuss the user and organisational impact study

### **Level E Institutionalised**

**Certainty** *"We know why we do not have problems with usability."* (pace Crosby, level V)

What measures have you used in the survey to predict the client's required quality-in-use for their accounts system next year?  
 How are the usability tests of the programmer's format for context of use statements going?  
 We have solved the problem with the variance in the user satisfaction tool and updated the work instructions  
 The first release will fully meet the client's needs. Updates will be based on field studies which monitor changes in organisational requirements  
 They have achieved the predicted improvements of 50% in effectiveness, 20% in efficiency and 30% in satisfaction after changing the office layout and replacing the PC network with our design of reference card system.  
 How did the workload study for the changes to the QMS go?

## Annex 5: Document Control

version	date	by	changes made	file
0.1	24/9/97	JVE	First draft of document containing HC processes and capability and HC maturity scales. Including HCD process definitions and base practices from old UMM. Including new 'human-centredness' scale attributes and indicators from UMM base practices. Users and How to Use sections. Some refinement of practices.	D514_a D514_b
0.2	20/10/97	JVE	Separation of processes and scale. Conversion into a checklist. Addition of edited overview and introductory text from 5.1.4(p). Revision of level names. Addition of recording forms, tidying of Scale introduction.	D514s_a
1.0	6-29 /1/98	JVE	Revision following review comments. Revision of abstract. Re-wording and some revision of Management Practices. Addition of executive summary. Addition of diagram in Annex 1. Movement of stakeholder analysis to Annex. Re-ordering of Annexes to reflect order of reference.	D514s_1 a
1.1	23/3/98	JVE	Addition of copyright. Correction of references to INUSE reports.	D514s_1 b
1.2	27/12/98	JVE	Revision of title and text for MP C.3.1. Addition of MP D2.3 and movement of part of text from D2.2 into this new practice. Revision of relevant fields in the Recording form. Addition of last line to Abstract.	D514s_1 c