ISO and Industry Standards for User Centred Design
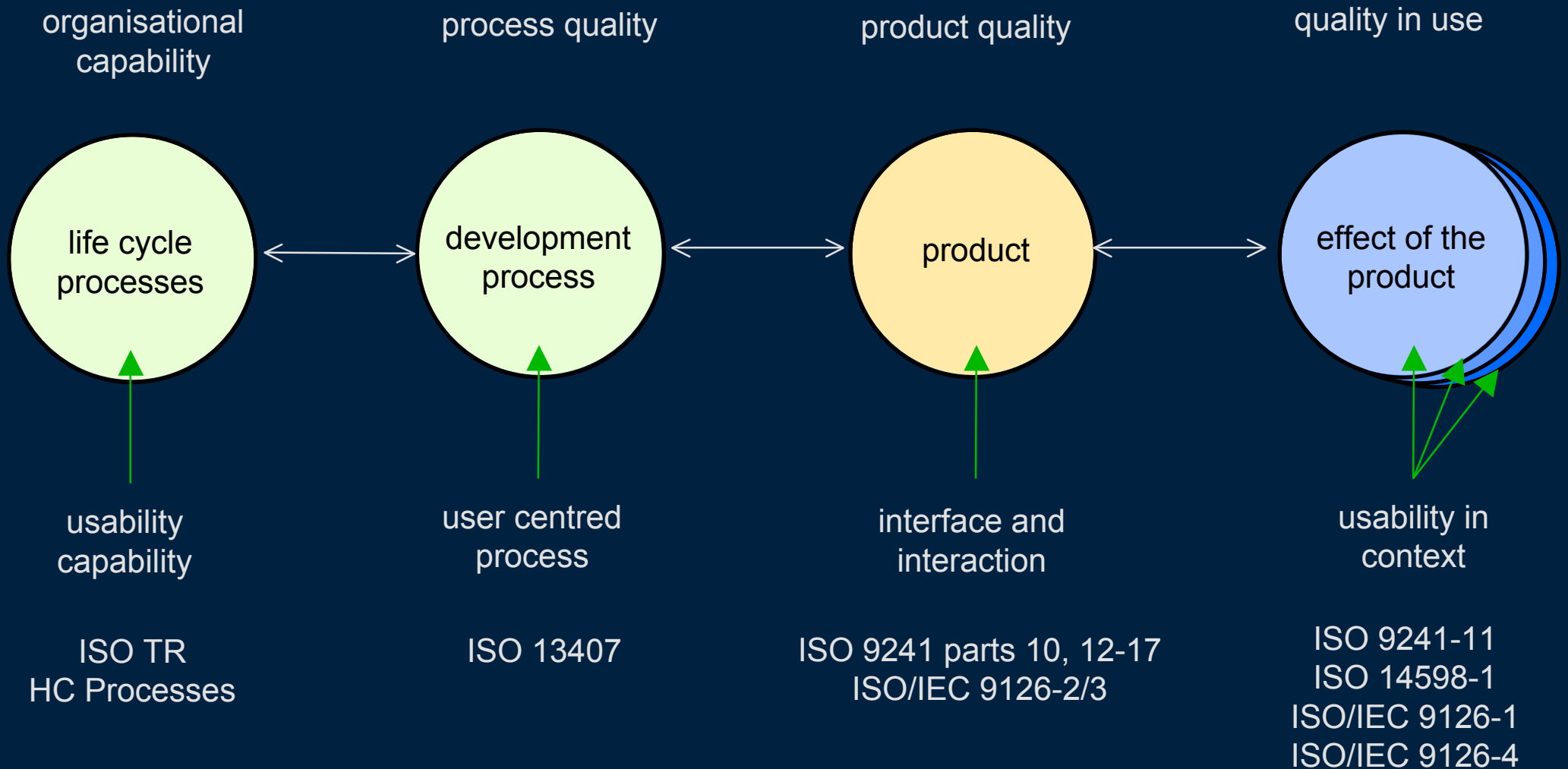
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October 2000

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Approaches to achieving usability

organisational capability

process quality

product quality

quality in use

life cycle processes

development process

product

effect of the product

usability capability

user centred process

interface and interaction

usability in context

ISO TR
HC Processes

ISO 13407

ISO 9241 parts 10, 12-17
ISO/IEC 9126-2/3

ISO 9241-11
ISO 14598-1
ISO/IEC 9126-1
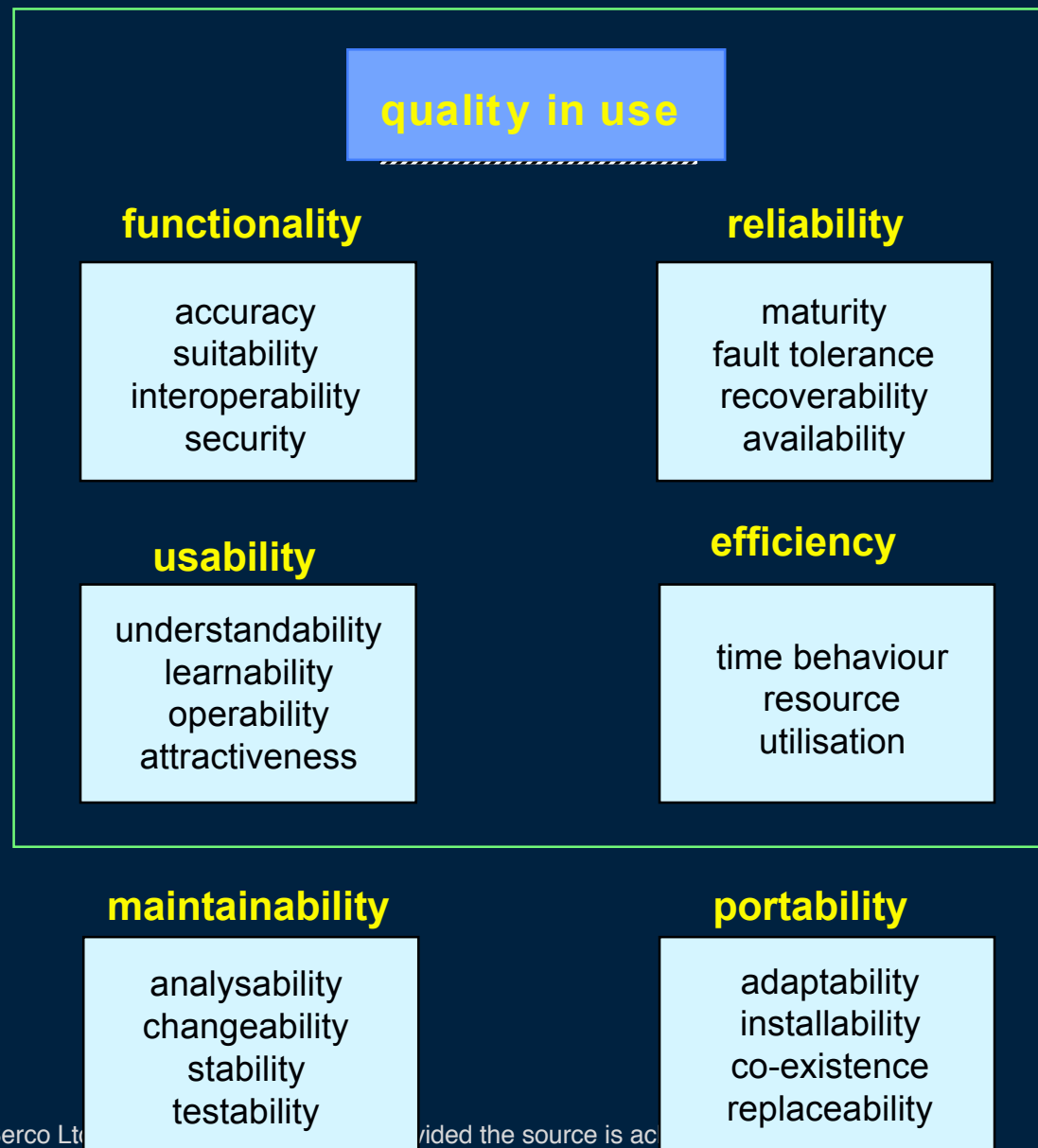ISO/IEC 9126-4

ISO 9241-11 Guidance on Usability

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

Effectiveness : The accuracy and completeness with which users achieve specified goals.

Efficiency : The resources expended in relation to the accuracy and completeness with which users achieve goals.

Satisfaction : The comfort and acceptability of use

ISO/IEC 9126-1 Software Product Quality Model

quality in use

functionality

accuracy
suitability
interoperability
security

reliability

maturity
fault tolerance
recoverability
availability

usability

understandability
learnability
operability
attractiveness

efficiency

time behaviour
resource
utilisation

maintainability

analysability
changeability
stability
testability

portability

adaptability
installability
co-existence
replaceability

ISO/IEC 9126-1 Definitions

- Functionality
  - The capability of the software product to provide functions which meet stated and implied needs when the software is used under specified conditions.

- Reliability
  - The capability of the software product to maintain a specified level of performance when used under specified conditions

- Usability
  - The capability of the software product to be understood, learned, used and attractive to the user, when used under specified conditions.

- Efficiency
  - The capability of the software product to provide appropriate performance, relative to the amount of resources used, under stated conditions.

- Maintainability
  - The capability of the software product to be modified. Modifications may include corrections, improvements or adaptation of the software to changes in environment, and in requirements and functional specifications.

- Portability
 - The capability of the software product to be transferred from one environment to another.

Quality in Use

ISO/IEC FDIS 9126-1 Software product quality -
Part 1: Quality model

quality in use

The capability of the software product to enable specified users to achieve specified goals with effectiveness, productivity, safety and satisfaction in specified contexts of use.

- – Quality in use is the user's view of the quality of a system containing software, and is measured in terms of the result of using the software, rather than properties of the software itself
- – Quality in use measures the combined effect of ease of use, functionality, efficiency and reliability.

Usability and quality
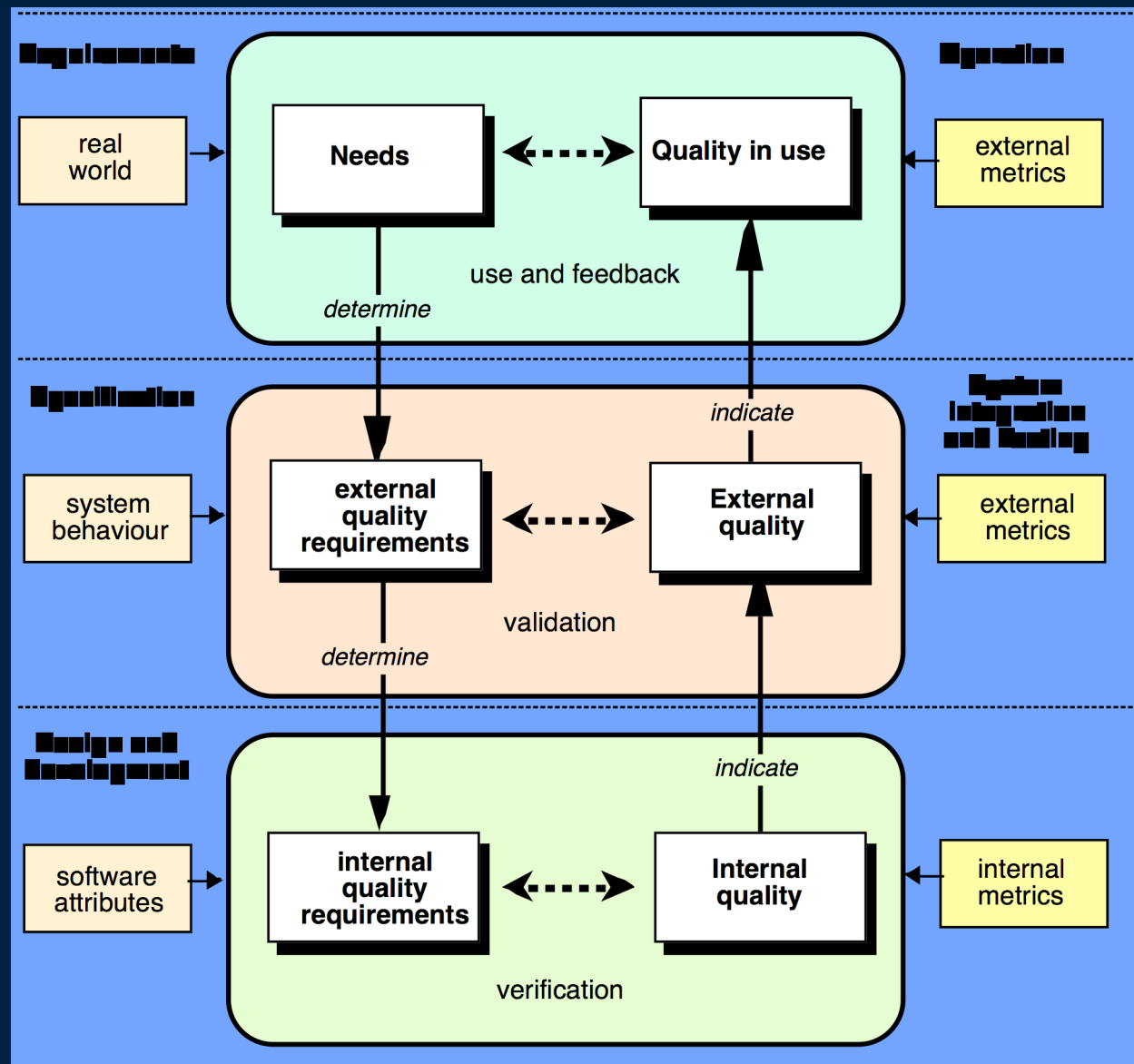
ISO 14598-1
Software Product
Evaluation -
General Overview

Quality in use metrics

- Quality in use metrics measure the extent to which a product meets the needs of specified users to achieve specified goals with
  - effectiveness,
  - productivity,
  - safety and
  - satisfaction

  in a specified context of use.

ISO/IEC 9126-4 Effectiveness metrics

- ***Task effectiveness*** What proportion of the task is completed correctly?

- ***Task completion*** What proportion of the tasks are completed?

- ***Error frequency*** What is the frequency of errors?

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ISO/IEC 9126-4 Productivity metrics

- ***Task time*** How long does it take to complete a task?
- ***Waiting time*** What proportion of the time do users spend waiting for the system to respond?
- ***Task efficiency*** How efficient are the users?
- ***Economic productivity*** How cost-effective is the user?
- ***Productive proportion*** What proportion of the time is the user performing productive actions?
- ***Relative user productivity*** How productive is a user compared to an expert?
- ***Help frequency*** What is the frequency of use of help?

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ISO/IEC 9126-4 Safety metrics

- ***User health and safety***   What is the incidence of health problems among users of the product?

- ***Safety of people affected by use of the system***   What is the incidence of hazard to people affected by use of the system?

- ***Economic damage***   What is the incidence of economic damage?

- ***Software damage***   What is the incidence of software corruption?

ISO/IEC 9126-4 Satisfaction metrics

- ***Satisfaction scale*** How satisfied is the user?

- ***Satisfaction questionnaire*** How satisfied is the user with specific software features?

- ***Discretionary usage*** What proportion of potential users choose to use the system?

Usability Requirements: Quality in use

- Establish requirements for effectiveness, efficiency and satisfaction for the user groups and tasks identified in the context of use analysis and in the scenarios.
    - Arrange a workshop attended by:
        - user(s)
        - developer(s).
    - You will also need a facilitator and a person to record the issues raised during the meeting.
    - Review each task along with their associated task scenarios to confirm their relevance and importance.
    - Decide which task(s) and user type(s) needed usability criteria.
    - For each chosen task and user type estimate:
        - the acceptable task time and the optimum target
        - how to score effectiveness by agreeing what errors the user might make
        - the effectiveness target
   - the satisfaction target.

Usability Requirements: Quality in use

- ## User performance
  - "all data entry clerks will be able to complete the task with at least 95% accuracy in under 10 minutes"

- ## User satisfaction
  - "the mean score on the SUMI scale will be greater than 50" More information on quality in use requirements

Measure the effect of the product

Usability/quality in use measures:

- Effectiveness and efficiency
  - MUSiC Performance Measurement Method
    http://www.usability.serco.com/publs.html

- Satisfaction
  - SUMI questionnaire
    www.ucc.ie/hfrg/questionnaires/sumi

- Reporting usability
  - Common industry format for usability test results
  - includes intended context of use and actual context of evaluation
    www.nist.gov/iusr

Efficiency: mean transaction times
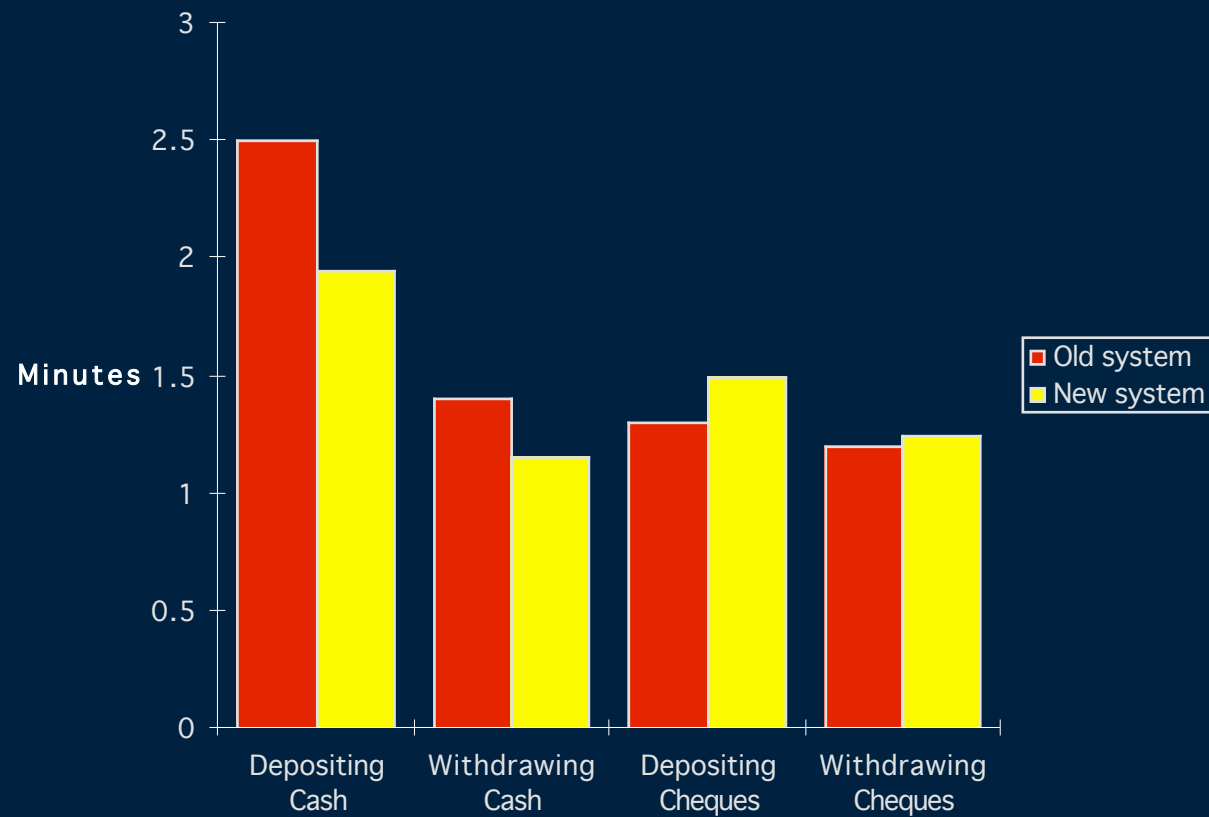
Satisfaction: SUMI questionnaire
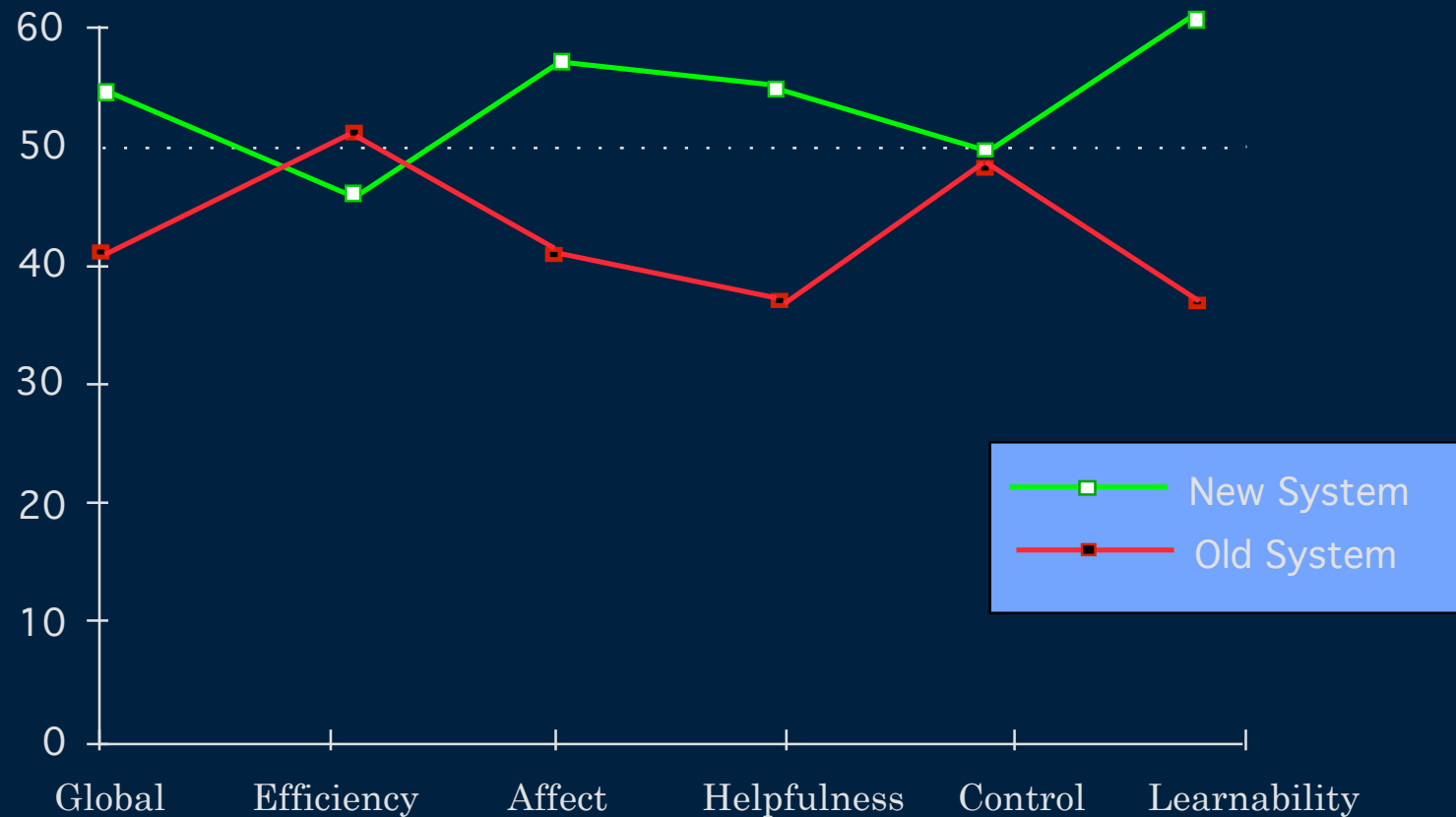
Common Industry Format usability tests

- NIST initiative
    - National Institute of Standards and Technology
- Objective: raise the profile of usability in procurement
- Suppliers provide standard test reports to purchasers
- Suppliers include:
    - IBM, Microsoft, HP, Sun, Oracle, Compaq
- Purchasers include:
    - Boeing, Northwest Mutual Life, State Farm Insurance, Kodak, Fidelity
- Reports provided in confidence
- Could permit comparisons
- Trials about to start
- Likely to be included in ISO TR 9126-4 Quality in use metrics

    http://www.nist.gov/iusr
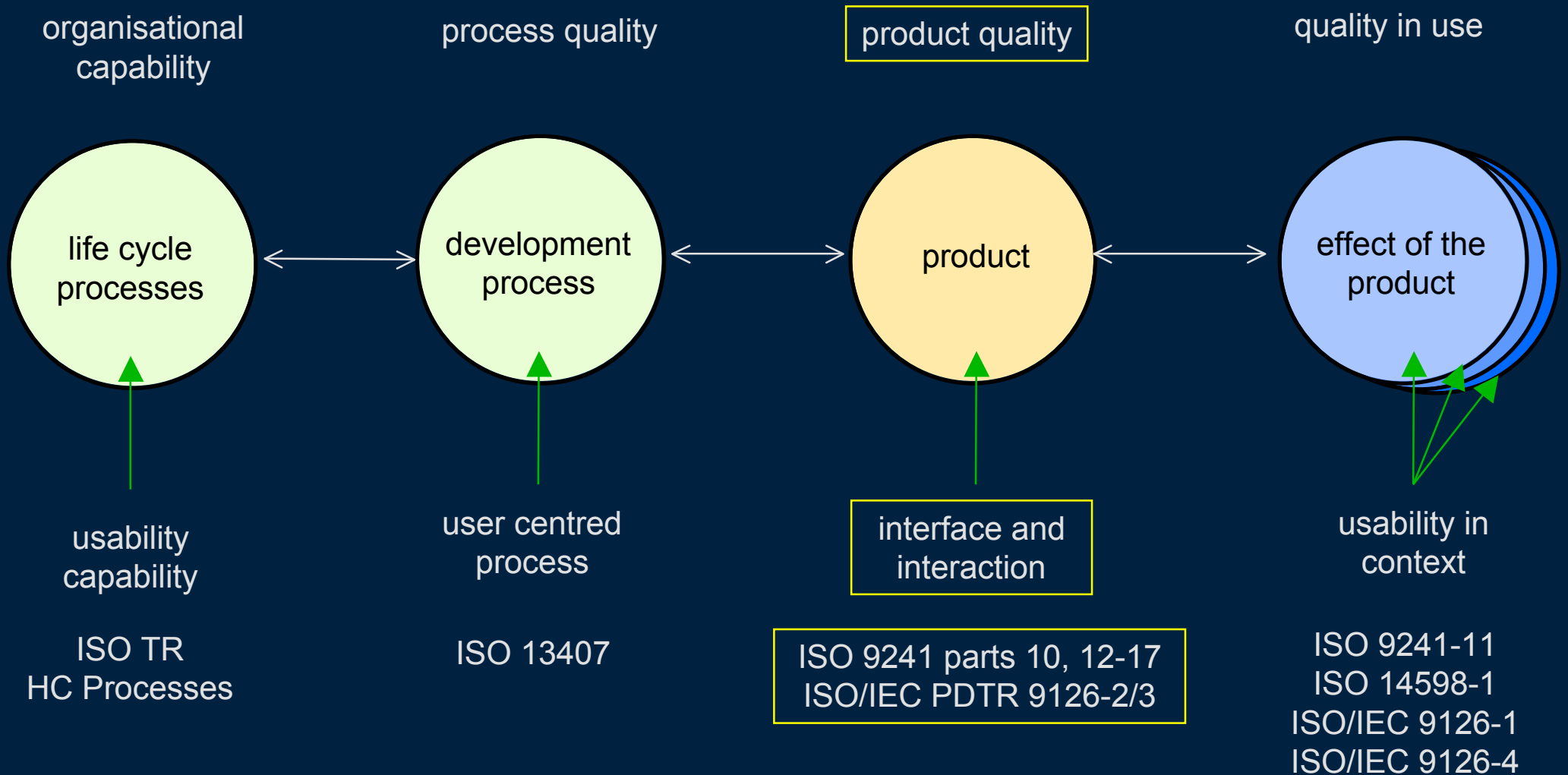
Report format: overview

- Title page
  - Name of product and version
  - When the test was conducted
  - Contact details for more information

- Executive summary
  - Reason for and nature of test
  - Test method, number of participants and tasks
  - Results (mean scores)
  - If differences are claimed, probability not due to chance

- Product description
  - Intended users and environment of use
  - Type of work supported
  - What parts were evaluated

How it will work

- Purchaser requests supplier to provide a CIF report
  - initially as part of agreed trials

- The supplier may already be planning a usability test
  - may have to adapt the test plan to be suitable for CIF report

  or

- The supplier asks the purchaser to carry out the test

  or

- The supplier asks a third party to carry out the test

- The test results help the purchaser decide
  - whether to purchase
  - whether to request changes

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ISO 9241
Ergonomic requirements for office work with visual display terminals

Parts 10 to 17 give guidance on software

10 Dialogue principles

11 Guidance on usability

12 Presentation of information

13 User guidance

14 Menu dialogues

15 Command Language dialogues

16 Direct Manipulation dialogues

17 Form-filling dialogues

Usability Requirements: external usability
ISO/IEC PDTR 9126-2/3: External/Internal metrics

Metrics (which can be tested by using a prototype/specification)

- Understandability
  - Product description and demonstrations
  - Interface functions (eg menus) easy to understand

- Learnability
  - Functions learnt quickly
  - Effective user documentation and help

- Operability
  - Consistency, self explanatory messages, undoability, customisability

- Attactiveness
  - Screen layout and colour

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ISO Technical Reports

- Internal usability metrics: ISO/IEC 9126-3

- External usability metrics: ISO/IEC 9126-2

- Quality in use metrics: ISO/IEC 9126-4

Understandability

- Users should be able to select a software product which is suitable for their intended use. Understandability metrics assess whether new users can understand:

    - whether the software is suitable

    - how it can be used for particular tasks.

ISO/IEC 9126-2 Understandability metrics

- ***Completeness of description***   What proportion of functions (or types of function) are understood after reading the product description?

- ***Demonstration Accessibility***   What proportion of the demonstrations/ tutorials can the user access?

- ***Demonstration Accessibility in use***   What proportion of the demonstrations / tutorials can the user access?

- ***Demonstration effectiveness***   What proportion of functions can the user operate successfully after a demonstration or tutorial?

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ISO/IEC 9126-2 Understandability metrics

- *Evident functions*   What proportion of functions (or types of function) can be identified by the user based upon start up conditions?

- *Function understand-ability*   What proportion of interface functions are understandable?

- *Understandable Input and Output*   Can users understand what is required as input data and what is provided as output by software system?

Learnability

- Learnability metrics assess how long it takes users to learn to use particular functions, and the effectiveness of help systems and documentation.

ISO/IEC 9126-2 Learnability metrics

- ***Ease of function learning*** How long does the user take to learn to use a function?

- ***Ease of learning to perform a task in use***   How long does the user take to learn how to perform the specified task efficiently?

- ***Help Accessibility***   What proportion of the help topics can the user locate?

- ***Effectiveness of the user documentation and/or help system*** What proportion of tasks can be completed correctly after using the user documentation and/or help system?

- ***Effectiveness of user documentation and help systems in use***   What proportion of functions can be used correctly after reading the documentation or using help systems?

Operability

- Operability metrics assess whether users can operate and control the software.

ISO/IEC 9126-2 Operability metrics

- *Operational Consistency in use* How easily user send his/her intention to or receive his/her expecting results from software through what user see?

- *Error correction* Can user easily correct error on tasks?

- *Error correction in use* Can user easily recover his/her error or retry tasks?

- *Default value availability in use* Can user easily select parameter values for his/her convenient operation?

- *Message understandability in use* Can user easily understand messages from software system?
  Is there any message which brought delay for user to understand and to start next action?
  Can user easily memorise important message?

ISO/IEC 9126-2 Operability metrics

- *Self-explanatory error messages*   In what proportion of error conditions does user propose correct recovery action?

- *Operational error recoverability in use*   Can user easily recover his/her worse situation?

- *Time Between Human Error Operations in use*   Can user operate the software long enough without human error?

- *Undoability*   How frequently does the user successfully correct input errors?

- *Customisability*   Can user easily customise operation procedures for his/her convenience?
What proportion of functions can be customised?

- *Operation procedure reduction* Can user easily reduce operation procedures for his/her convenience?

- *Physical accessibility*   What proportion of functions can be accessed by users with physical handicaps

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Attractiveness

- Attractiveness metrics assess the appearance of the software, and will be influenced by factors such as screen design and colour.
  - This is particularly important for consumer products.

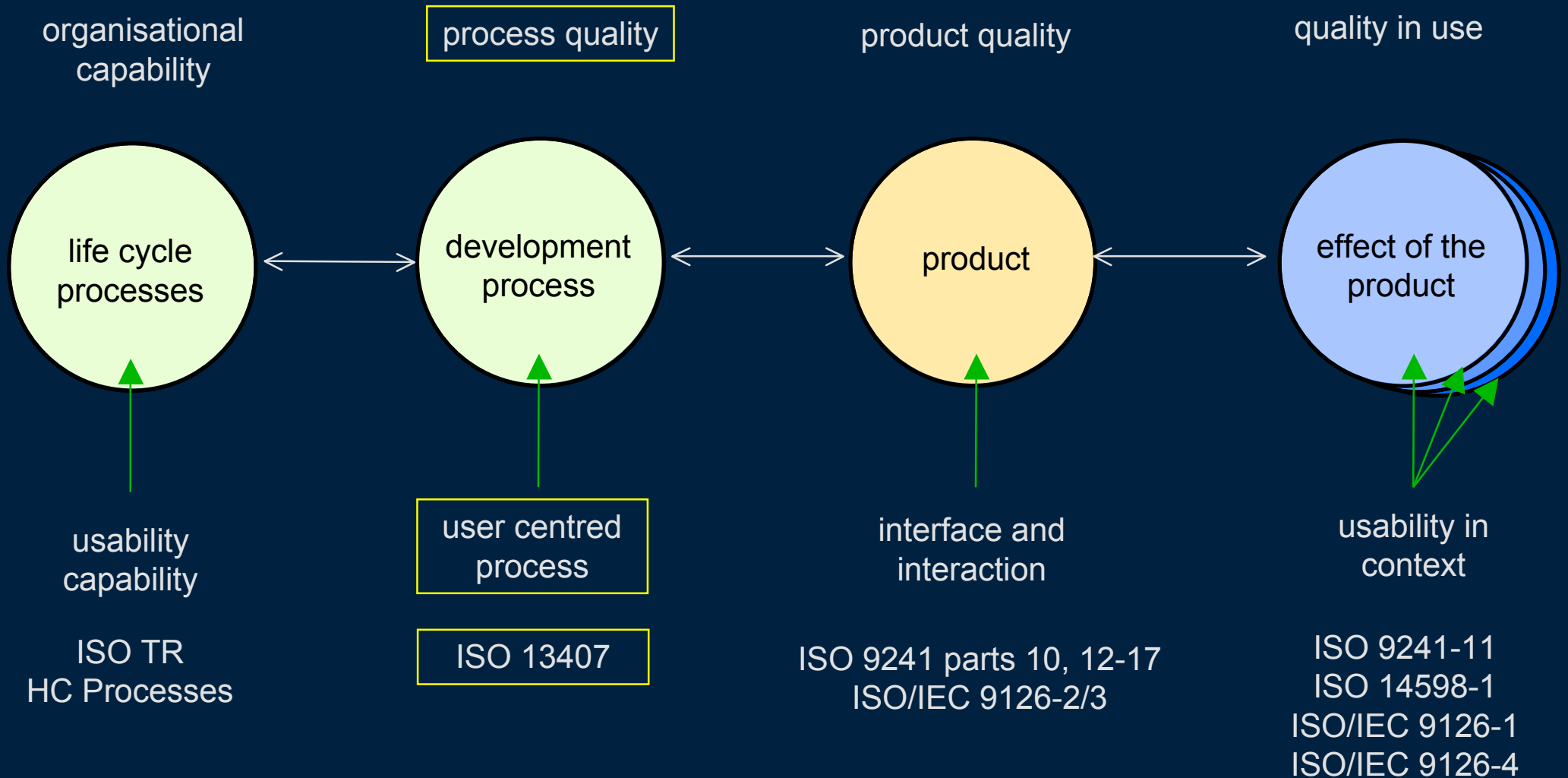## ISO/IEC 9126-2 Attractiveness metrics

- *Attractive interface* How attractive is the interface to the user?

- *Interface appearance customisability* What proportion of interface elements can be customised in appearance to the user's satisfaction?
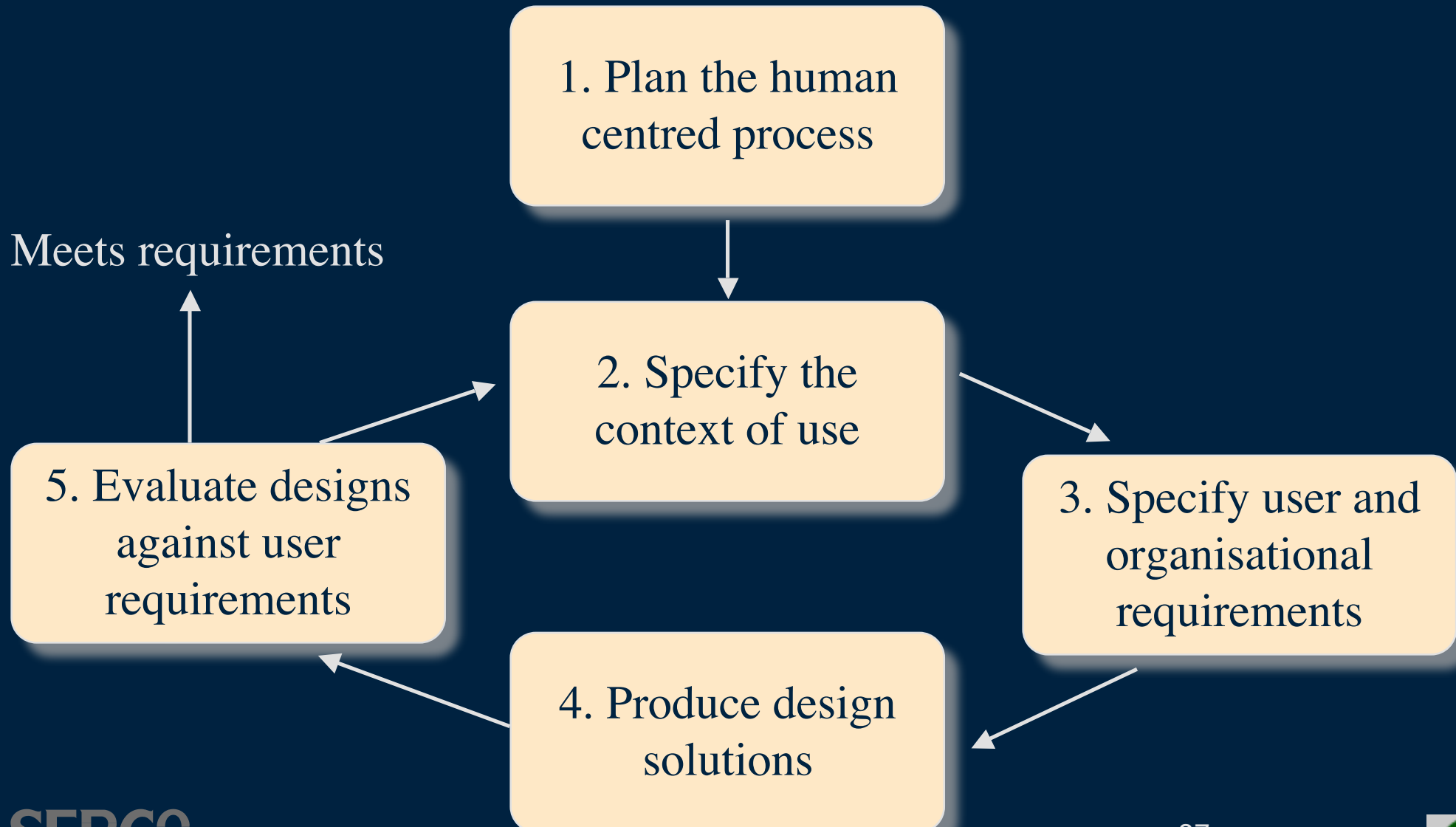
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Detailed usability requirements

- Understandability
  - Interface elements (e.g. menus, controls) should be easy to understand
  - For a walk up and purchase or use system, the purpose of the system should be easily understandable
- Learnability
  - The user documentation and help should be complete
  - The help should be context sensitive and explain how to achieve common tasks
  - The system should be easy to learn
- Operability
  - The interface actions and elements should be consistent
  - Error messages should explain how to recover from the error
  - Undo should be available for most actions
  - Actions which cannot be undone should ask for confirmation
  - The system should be customisable to meet specific user needs
  - A style guide should be used
- Attractiveness
  - The system design and screen layout and colour should be appealing

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organisational
capability

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quality in use

life cycle processes ⟷ development process ⟷ product ⟷ effect of the product

usability
capability

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ISO/IEC 9126-4

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Human centred design process for interactive systems ISO 13407

```
          ┌──────────────────────┐
          │  1. Plan the human   │
          │   centred process    │
          └──────────┬───────────┘
                     │
                     ▼
          ┌──────────────────────┐
Meets     │    2. Specify the    │─────────┐
requirements ↑  │   context of use  │        │
          └──────────────────────┘          ▼
```

1. Plan the human centred process

Meets requirements

2. Specify the context of use

5. Evaluate designs against user requirements

3. Specify user and organisational requirements

4. Produce design solutions

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Improve the process

- ISO 13407

    Human-centred design process for interactive systems

- Principles of user-centred design
    – understand the users and their tasks
    – evaluate prototypes with users
    – iterative development

- Conformance
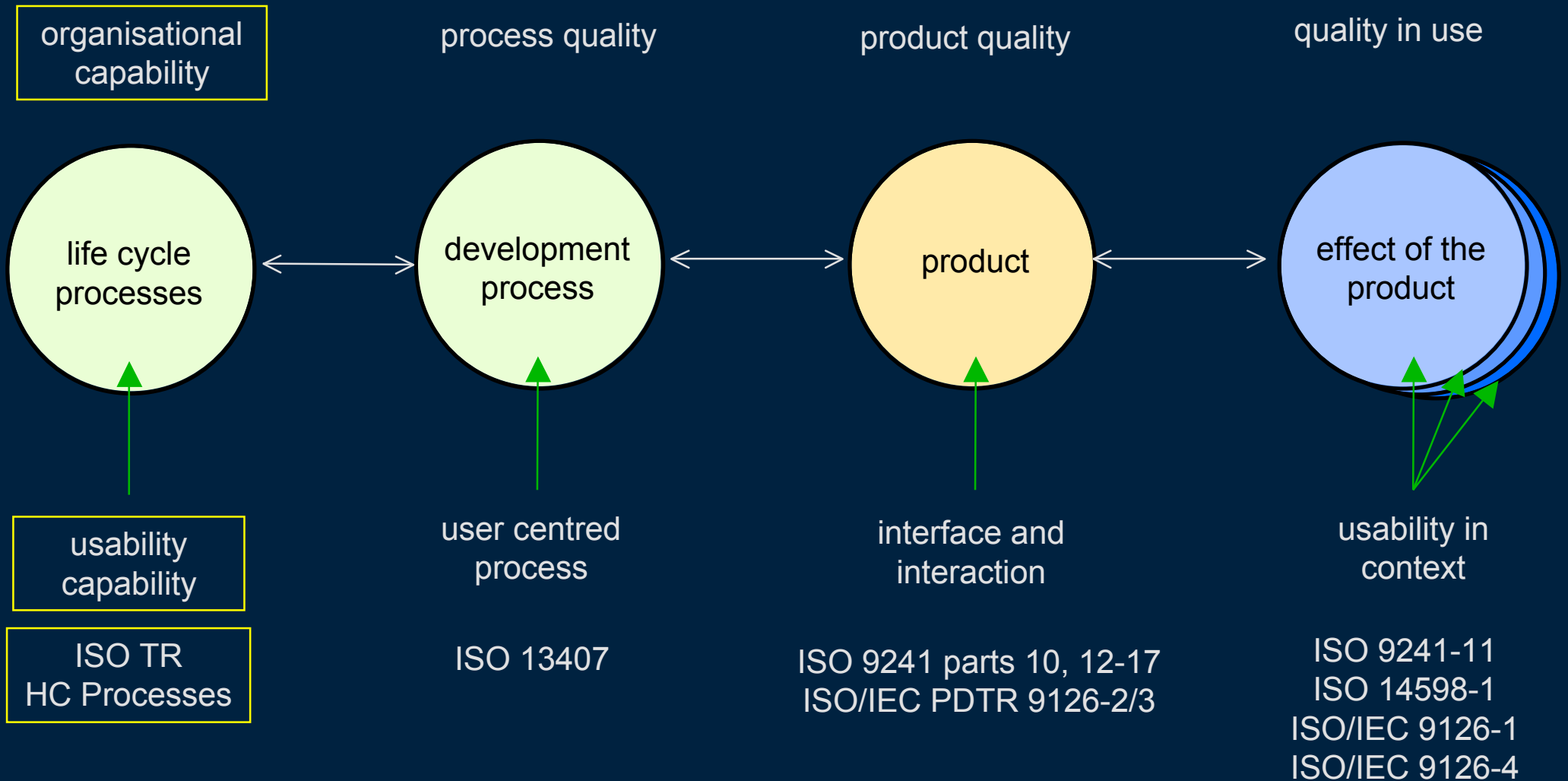   – State what methods have been used

Evaluate the specific development process
ISO 13407 lite conformance assessment (INUSE)

Provide information to show that user centred design activities have been carried out throughout the lifecycle:

- Plan the human-centred development process for IT products
- Specify the context of use
- Specify user and organisational requirements
- Produce design solutions
- Evaluate design solutions against user and organisational requirements

www.lboro.ac.uk/eusc

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organisational capability
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    product quality
    quality in use

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ISO/IEC 9126-4

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Evaluate the organisational processes
Usability Maturity Model (INUSE)

HCD.1 Ensure HCD content in system strategy

HCD.2 Plan and manage the HCD 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

Applied and refined by Lloyds Register in software, telecoms and defence companies in UK, France, Sweden and Finland.

ISO TR: Human-centred lifecycle processes descriptions

Usability support provider accreditation scheme (INUSE)

Provide evidence of the necessary skills, tools and established processes to provide support in:

- Usability consultancy services
- Plan user centred design
- Evaluation and testing
- Requirements engineering
- Product design support
- Training courses
- Technology transfer

www.lboro.ac.uk/eusc

Usability Maturity Model

Application in EC TRUMP project

Lloyds Register

- SPICE (ISO/IEC 15504) project assessment at Inland Revenue
  - 2 assessors for one week

Serco Usability Services

- Process improvement workshop at IAI
  - One day workshop with one facilitator