

# Reducing Risk Through Human Centred Design

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# National Academies Report

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- Human-System Integration in the System Development Process: A New Look
  - [http://books.nap.edu/openbook.php?record\\_id=11893](http://books.nap.edu/openbook.php?record_id=11893)
  
- An Initial Theory of Value-Based Software Engineering
  - Barry Boehm, 2005
  - [groups.yahoo.com/group/UsabilityRisk](http://groups.yahoo.com/group/UsabilityRisk)

# Managing project risks (Boehm and Lane)

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- 1. Identify and satisfy success-critical stakeholders**
2. Incremental growth of system definition and stakeholder commitment
3. Iterative system development and definition
4. Concurrent engineering of requirements and solutions
- 5. The level of detail of specific products and processes should depend on the level of risk associated with them**

# Success-critical stakeholders

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- ❑ Sponsors: Deliver on time, on budget, to specification
- ❑ Customers: Meets customer needs
- ❑ Marketing: Easy to market, good reviews
- ❑ Sales: Increased sales
- ❑ Training: Minimised training

“The SCSs can include considerably more classes than users, customers, and developers. Additional SCS classes can include maintainers, administrators, interoperators of co-dependent systems, testers, marketers, venture capitalists, and, representatives of the least-advantaged people whose health, lives, or quality of life may be affected by the system.”

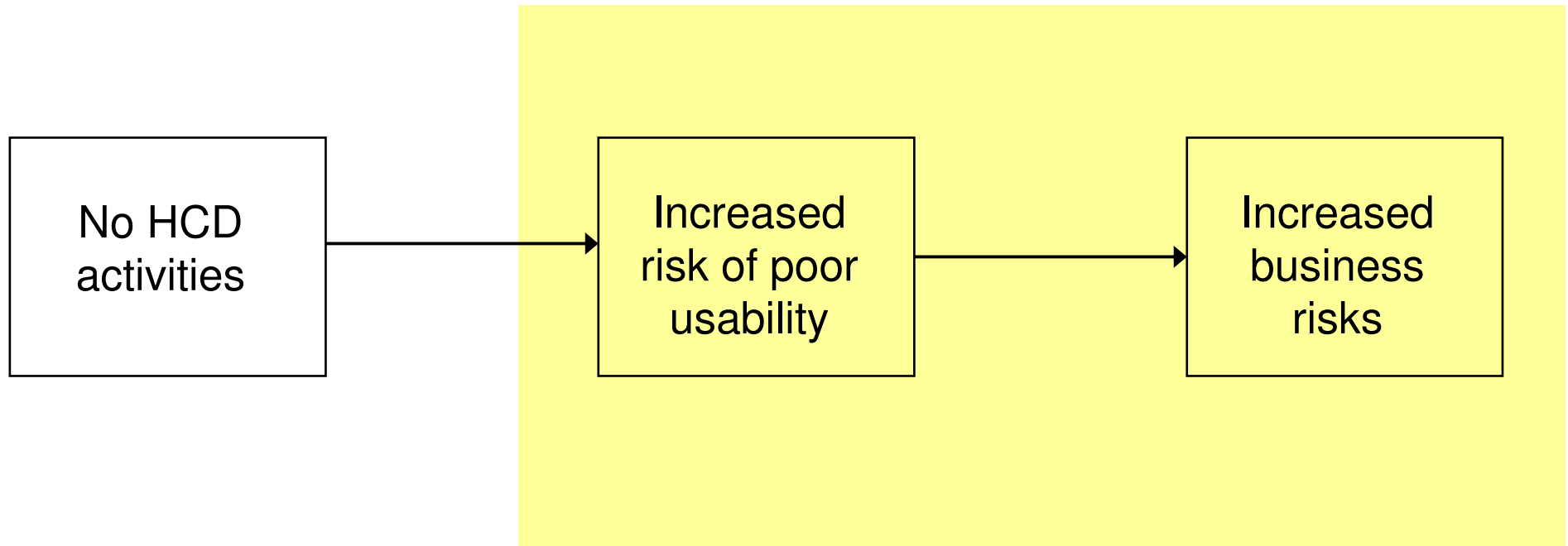
# Existing approaches to cost-benefit analysis

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- Much work has been done on cost justifying usability
  - e.g. Bias and Mayhew 1994, Bias and Mayhew 2005
  - Bevan, N. (2005). Cost benefits framework and case studies. In Bias and Mayhew 2005
  
- Existing approaches:
  - tend to justify the need for usability in general rather than selectively justifying particular methods
  - focus on cost benefits rather than risks
  
- Managers may be more motivated to reduce risk than by potential cost benefits

# Risks

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# Typical risks

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| <b>Stakeholder</b> | <b>Success criteria</b>                      | <b>Risk if poor usability</b>         |
|--------------------|--|---------------------------------------|
| Sponsors           | Deliver on time, on budget, to specification | Increased development to fix problems |
| Customers          | Meets customer needs                         | Customer rejects the product          |
| Marketing          | Easy to market, good reviews                 | Poor reputation, difficult to market  |
| Sales              | Increased sales                              | Reduced sales                         |
| Training           | Minimised training                           | Increased training                    |

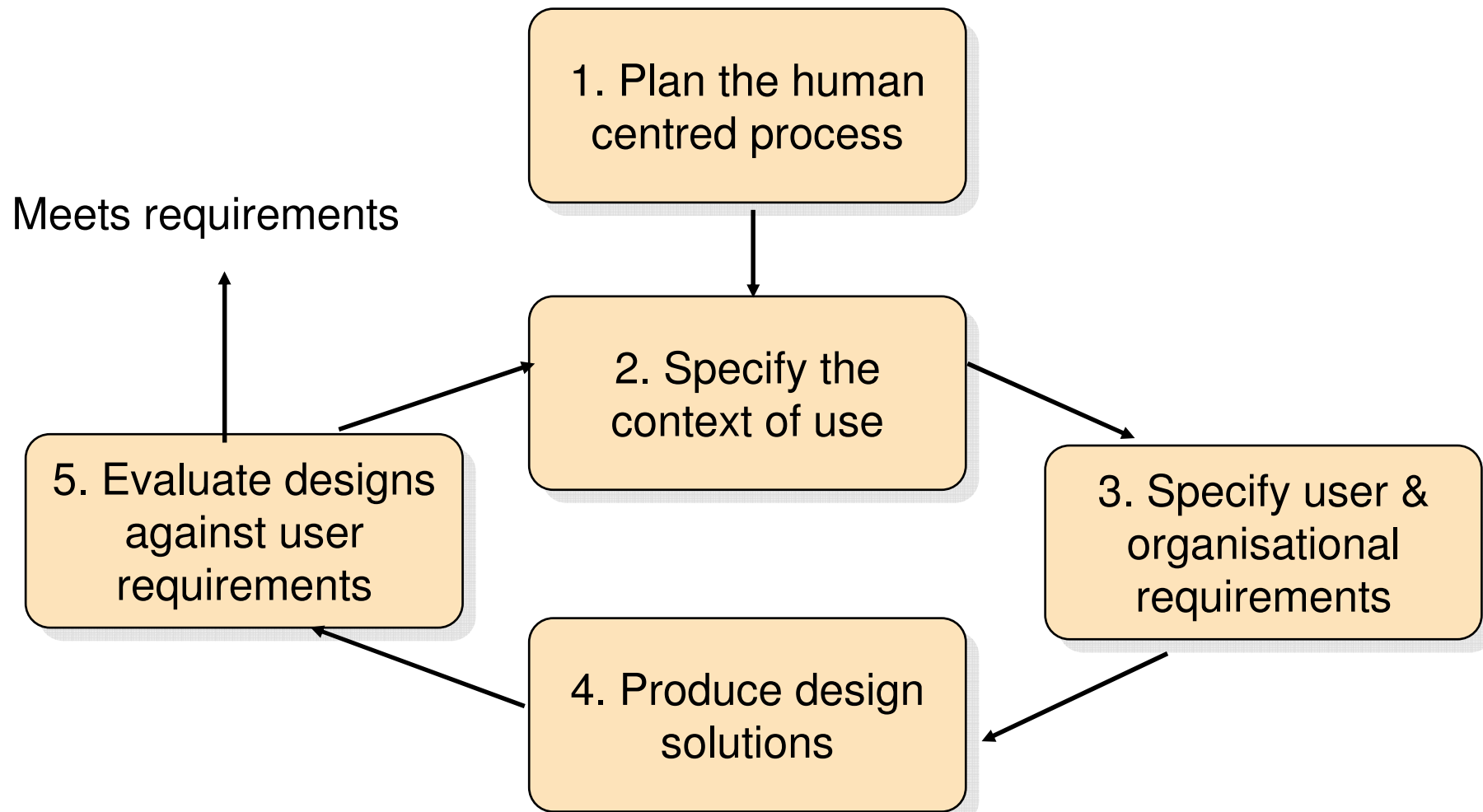
# Selecting methods

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1. Identify the success-critical stakeholders.
2. Identify which potential consequences of good/poor usability affect the success-critical stakeholders.
3. Assess the likelihood and impact of these consequences.
4. Identify which categories of HCD activities can increase benefits/reduce risks.
5. Identify which HCD methods in each category are most cost-effective.
  - To what extent will each possible method address the activities that have been identified as important?
  - How cost effective is each method likely to be, given the time and effort required and constraints such as available skills, access to stakeholders and other users, etc.?

# Classification based on ISO 13407: Human centred design process for interactive systems

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# ISO PAS 18152: A specification for the process assessment of human-system issues

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## HS.1 Life cycle involvement activities

- HS.1.1 HS issues in conception
- HS.1.2 HS issues in development
- HS.1.3 HS issues in production and utilization
- HS.1.4 HS issues in utilization and support
- HS.1.5 HS issues in retirement

## HS.2 Integrate human factors activities

- HS.2.1 HS issues in business strategy
- HS.2.2 HS issues in quality management
- HS.2.3 HS issues in authorisation and control
- HS.2.4 Management of HS issues
- HS.2.5 HF data in trade-off and risk mitigation
- HS.2.6 User involvement
- HS.2.7 Human-system integration
- HS.2.8 Develop and re-use HF data

## HS.3 Human-centred design activities

- HS.3.1 Context of use
- HS.3.2 User requirements
- HS.3.3 Produce design solutions
- HS.3.4 Evaluation of use

## HS.4 Human resources activities

- HS.4.1 Human resources strategy
- HS.4.2 Define standard competencies and identify gaps
- HS.4.3 Design staffing solution and delivery plan
- HS.4.4 Evaluate system solutions and obtain feedback

# Project manager view of systems development

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1. Envisioning opportunities
  2. System scoping
  3. Understanding needs
  4. Requirements
  5. Architecting solutions
  6. Life-cycle planning
  7. Evaluation
  8. Negotiating commitments
  9. Development and evolution
  10. Monitoring and control
  11. Operations and retirement
  12. Organizational capability improvement
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# Human-system activities in systems development

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1. Envisioning opportunities
2. System scoping
3. Understanding needs
  - a) Context of use
  - b) Tasks
  - c) Usability needs
  - d) Design options
4. Requirements
  - a) Context requirements
  - b) Infrastructure requirements
  - c) User requirements
5. Architecting solutions
  - a) System architecting
  - b) Human elements
  - c) Hardware elements
  - d) Software elements
6. Life-cycle planning
  - a) Planning
  - b) Risks
  - c) User involvement
  - d) Acquisition
  - e) Human resources
7. Evaluation
  - a) Risks
  - b) Plan and execute
- c) Validation
- d) HSI knowledge
- e) Staffing
8. Negotiating commitments
  - a) business case
  - b) requirements
9. Development and evolution
10. Monitoring and control
11. Operations & retirement
  - a) Operations
  - b) Retirement
12. Organizational capability improvement

# ISO 13407-related activities for method classification

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1. Understand and specify the context of use
  1. Envisioning opportunities
  2. System scoping
  3. Context of use (users and environment)
  4. Tasks
2. Specify the user and organizational requirements
  1. Usability needs
  2. Requirements for context of use
  3. Requirements for system infrastructure
  4. User requirements
3. Produce design solutions
  1. Design options
  2. System architecting
  3. Function allocation
4. Evaluate designs against requirements
  1. Risk assessment
  2. Identify problems
  3. Validation (summative evaluation)
  4. Evaluate based on HF knowledge

# Selecting methods

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1. Identify which categories of HCD activities can increase benefits/reduce risks to the project stakeholders at each stage of development.
2. Identify which HCD methods in each category are most cost-effective.
  - To what extent will each possible method address the activities that have been identified as important?
  - How cost effective is each method likely to be, given the time and effort required and constraints such as available skills, access to stakeholders and other users, etc.?

# 1.1 Context of use: Envisioning opportunities

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| <b>Best practices for risk mitigation</b>  | <b>Methods</b>  |
|--|---|
| <ul style="list-style-type: none"><li>• Identify expected context of use of systems [forthcoming needs, trends and expectations].</li><li>• Analyze the system concept [to clarify objectives, their viability and risks].</li></ul> | <ul style="list-style-type: none"><li>• Preliminary field visit</li><li>• Focus groups</li><li>• Analyse existing systems</li><li>• Future workshop</li></ul> |

## Risks

- Putting resources into a concept that does not match with user and market needs

## 1.2 Context of use: System scoping

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| Best practices for risk mitigation  | Methods  |
|---|--|
| Describe the objectives which the user or user organization wants to achieve through use of the system. | <ul style="list-style-type: none"><li>• Field observations and ethnography</li><li>• Stakeholder meeting</li><li>• Participatory workshops</li></ul> |
| Define the scope of the context of use for the system.  | <ul style="list-style-type: none"><li>• Context of use analysis</li></ul>  |

### Risks

- Conflicting objectives
- Ambiguous scope

# 1.3 Context of use: Users and environment

| <b>Best practices for risk mitigation</b>  | <b>Methods</b>   |
|--|--|
| <ul style="list-style-type: none"><li>• Identify and analyze the roles of each group of stakeholders likely to be affected by the system</li><li>• Describe the characteristics of the users</li><li>• Describe the cultural environment/ organizational/ management regime</li><li>• Describe the characteristics of any equipment external to the system and the working environment</li><li>• Describe the location, workplace equipment and ambient conditions</li><li>• Present context and human resources options and constraints to the project stakeholders</li></ul> | <ul style="list-style-type: none"><li>• Success critical stakeholder identification</li><li>• Field Observations and ethnography</li><li>• Participatory workshop</li><li>• Work context analysis</li><li>* Context of use analysis</li><li>• Event data analysis</li><li>• Contextual enquiry</li></ul> |

# 1.4 Context of use: Tasks

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| <b>Best practices for risk mitigation</b> | <b>Methods</b>  |
|---|---|
| • Analyze the tasks and worksystem        | • Task analysis<br>• Cognitive task analysis<br>• Work context analysis |

## Context of Use: Risks

- Product does not support users' terminology, tasks, and working environment
- Product has unnecessary functionality

## 2.1 Requirements: Usability needs

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| <b>Best practices for risk mitigation</b>   | <b>Methods</b>   |
|---|--|
| <ul style="list-style-type: none"><li>• Perform research into required system usability</li></ul> | <ul style="list-style-type: none"><li>• Investigate required system usability</li><li>• Usability benchmarking</li></ul> |

### Risks

- No basis for establishing usability requirements

## 2.2 Requirements: Context of use

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| <b>Best practices for risk mitigation</b>  | <b>Methods</b>  |
|--|---|
| <ul style="list-style-type: none"><li>• Analyze the implications of the context of use</li><li>• Present context of use issues to project stakeholders for use in the development or operation of the system</li></ul> | <ul style="list-style-type: none"><li>• Define the intended context of use including boundaries</li></ul> |

### Risks

- Context of use ignored unless it is a specified requirement

## 2.3 Requirements: System infrastructure

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| <b>Best practices for risk mitigation</b>   | <b>Methods</b>  |
|---|---|
| <ul style="list-style-type: none"><li>• Identify, specify and produce the infrastructure for the system</li><li>• Build required competencies into training and awareness programs</li><li>• Define the global numbers, skills and supporting equipment needed to achieve those tasks</li></ul> | <ul style="list-style-type: none"><li>• Identify any training or support needed to ensure that users achieve acceptable performance</li></ul> |

### Risks

- Problems during roll-out due to inadequate infrastructure

## 2.4 User requirements

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| <b>Best practices for risk mitigation</b>   | <b>Methods</b>  |
|---|---|
| <ul style="list-style-type: none"><li>• Set and agree the expected behavior and performance of the system with respect to the user</li><li>• Develop an explicit statement of the user requirements for the system</li><li>• Analyze the user requirement</li><li>• Generate and agree on measurable criteria for the system in its intended context of use</li></ul> | <ul style="list-style-type: none"><li>• Scenarios</li><li>• Personas</li><li>• Storyboards</li><li>• Establish performance and satisfaction goals for specific scenarios of use</li><li>• Define detailed user interface requirements</li><li>• Prioritize requirements</li></ul> |

### Risks

- Increased costs for the user organisation due to poor productivity
- Rejected by users because too difficult to use

## 3.1 Design solutions: Options

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| Best practices for risk mitigation  | Methods   |
|---|---|
| <ul style="list-style-type: none"><li>• Generate design options for each aspect of the system related to its use and its effect on stakeholders</li><li>• Produce user-centred solutions for each design option</li></ul> | <ul style="list-style-type: none"><li>• Generate design options</li><li>• Early prototyping</li><li>• Parallel design</li></ul> |

### Risks

- Committing to an inappropriate or inadequate design solution

## 3.2 Design solutions: System architecting

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| Best practices for risk mitigation   | Methods   |
|--|---|
| <ul style="list-style-type: none"><li>• Design for customization</li><li>• Develop a practical model of the user's work</li><li>• Produce a description of how the system will be used</li><li>• Produce designs for the user-related elements of the system that take account of the user requirements, context of use and HF data</li><li>• Develop simulation or trial implementation of key aspects of the system for the purposes of testing with users</li></ul> | <ul style="list-style-type: none"><li>• Prototyping and usability evaluation</li><li>• Physical ergonomics</li><li>• Participatory design</li><li>• User interface guidelines and standards</li></ul> |

### Risks

- Making changes early is much less expensive than correcting mistakes once the product is built

## 3.3 Design solutions: Function allocation

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| <b>Best practices for risk mitigation</b>   | <b>Methods</b>  |
|---|---|
| <ul style="list-style-type: none"><li>• Distribute functions between the human, machine and organizational elements of the system best able to fulfil each function</li></ul> | <ul style="list-style-type: none"><li>• Function allocation</li></ul> |

## 4.1 Evaluation: Risk assessment

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| <b>Best practices for risk mitigation</b>  | <b>Methods</b>  |
|--|---|
| <ul style="list-style-type: none"><li>• Assess the health and well-being risks to the users of the system</li><li>• Assess the risks to the community and environment arising from human error in the use of the system</li><li>• Evaluate the current severity of emerging threats to system usability and other HS risks and the effectiveness of mitigation measures</li><li>• Assess the risks of not involving end users in each evaluation</li></ul> | <ul style="list-style-type: none"><li>• Risk analysis (process and product)</li></ul> |

## 4.2 Evaluation: General

| <b>Best practices for risk mitigation</b>  | <b>Methods</b>  |
|--|---|
| <ul style="list-style-type: none"><li>• Collect user input on the usability of the developing system</li><li>• Revise design and safety features using feedback from evaluations</li><li>• Plan the evaluation</li><li>• Identify and analyze the conditions under which a system is to be tested or otherwise evaluated</li><li>• Check that the system is fit for evaluation</li><li>• Carry out and analyze the evaluation according to the evaluation plan</li><li>• Understand and act on the results of the evaluation</li></ul> | <ul style="list-style-type: none"><li>• Obtain user feedback on usability</li><li>• Use models and simulation</li></ul> |

## 4.3 Evaluation: Validation (summative)

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| <b>Best practices for risk mitigation</b>  | <b>Methods</b>   |
|--|--|
| <ul style="list-style-type: none"><li>• Test that the system meets the requirements of the users, the tasks and the environment, as defined in its specification</li><li>• Assess the extent to which usability criteria and other HS requirements are likely to be met by the proposed design</li></ul> | <ul style="list-style-type: none"><li>• Compare with requirements</li><li>• Common Industry Format for usability reports</li><li>• Performance measurement</li></ul> |

### Risks

- Product not successful due to inadequate usability

## 4.4 Evaluation: Based on knowledge (expert)

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| Best practices for risk mitigation  | Methods |
|---|---------|
| • Review the system for adherence to applicable human science knowledge, style guides, standards, guidelines, regulations and legislation |         |

### Risks

- Product not successful due to inadequate usability

# Prerequisites

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Need usability experts in the development team who:

- can convince the project of the specific risks associated with poor usability
- have sufficient experience to be able to select the most cost effective HCD methods
- have the expertise and resources to apply a wide range of different types of methods.

# Needs to be applied in a project context

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- I would be happy to work with someone to implement this in a real project