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Effects of insufficient human factors focus in a design phase of new automated technology.

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IRIS · The Research Council of Norway · Statoil · IFE Institutt for energiteknikk · ConocoPhillips · cmr

The project

- eLAD project
  CMR, ConoccoPhilips, IFE, IRIS, Statoil
- Petromaks programme - The research council of Norway
- Safety in design and implementation of automated technology in the offshore petroleum industry.
- Started in 2008, completed data collection in 2012
- 43 interviews, surveys, offshore observations

Bilde: drillingcontractor.org

The implementation phase

- Purpose
  - investigate a drilling crew's acceptance of a new drilling technology and how this affected the perceived safety of their drilling activity
- Result
  - According to change theory (Armenakis and Harris 2009) the change was a success due to trust and acceptance of the technology

  - According to safety theory HRO (Weick and Sutcliffe, 2007) there was too much trust and no-one questioned the technology or the change process. Potentially a safety hazard

- Conclusion
  - The term trust should be more nuanced (Sætren and Laumann, 2014)

The design phase

- Co-authors – Sandra Hogenboom DNV-GL and Karin Laumann NTNU
- The purpose
  - investigate the safety aspects of a design team's work processes and the outcome of the design process.
- The research question:
  - How are safety through human factors and human reliability ensured during a design process of automated technology in a high-risk industry?
- Method
  - 7 interviews
  - Grounded theory
  - Participants:
    - Engineer designers, project team members.
- (Sætren, Hogenboom and Laumann, 2014)

Bilde: cobarch.com

Human centred design process

- Standards emphasizing prevention of human error:
  - ISO 11064-1 *Ergonomic design of control centres Part 1*
  - ISO 6385 *Ergonomic principles in the design of work systems*
  - Norsok S-002 *Work environment*
  - NS-EN 6140-2 *Safety of machinery. Ergonomic design principles. Part 2: Interactions between the design of machinery and work tasks*
  - The facilities regulations (Norwegian Petroleum Safety Authority)

ISO 6385

- Establish fundamental principles of ergonomics and human factors as basic guidelines for the design of work systems.
  - main purpose: involve human factors in the design regarding focusing on achieving a balance between the requirements:
    - human
    - social
    - technical
  - six phases:
    1. Formulation of goals (requirement analysis)
    2. Analysis and allocation of functions
    3. Design concept
    4. Detailed design
    5. Realization, implementation and validation
    6. Evaluation

Throughout this process, human factors analyses are recommended as tools to achieve a human-centred approach.

ISO 11064-1

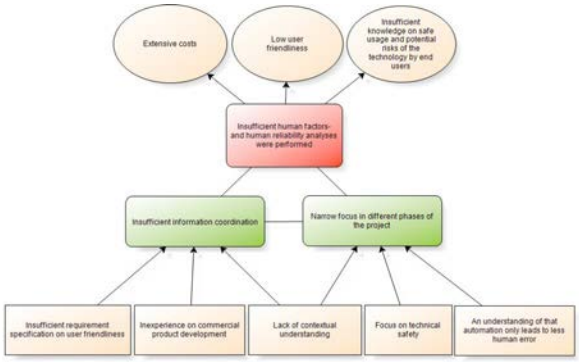
- Part of an international standard developed for designing control centers.
- Focus on elements such as
  - human centered design
  - integrating ergonomics in engineering practice
  - user participation
  - error tolerant design
  - feedback design
  - task analysis at every step of the process
- The design process described in the ISO 11064-1 is divided in five main phases:
  - *Phase A – Clarification*: at this stage it is important to clarify purpose and background material which includes the context, resources and the constraints of the project.
  - *Phase B – Analysis and definition:* at this stage an analysis of the functional and performance requirements of the system is advised.
  - *Phase C – Concept design*: in this phase it should be described how to develop initial designs such as displays and communications interfaces to be able to meet the needs identified in phase B.
  - *Phase D – Detailed design:* at this stage detailed design specifications necessary for the construction, its content, operational interfaces, and environmental facilities should be developed.
  - *Phase E – Operational feedback*: at this stage a post commissioning review to identify successes and shortcomings in the design in order to positively influence subsequent designs should be conducted.

Human centred design process

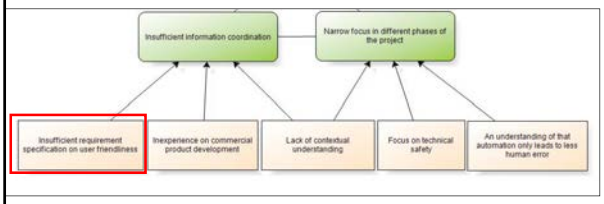
- Human factors and human reliability methods:
  - User analysis
  - Task analysis
  - Interface analysis
  - Human error identification analysis
- (Stanton et al., 2013)

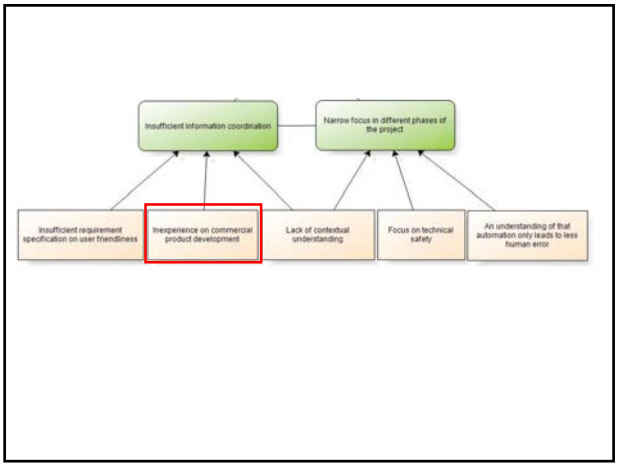
The complexity in the project

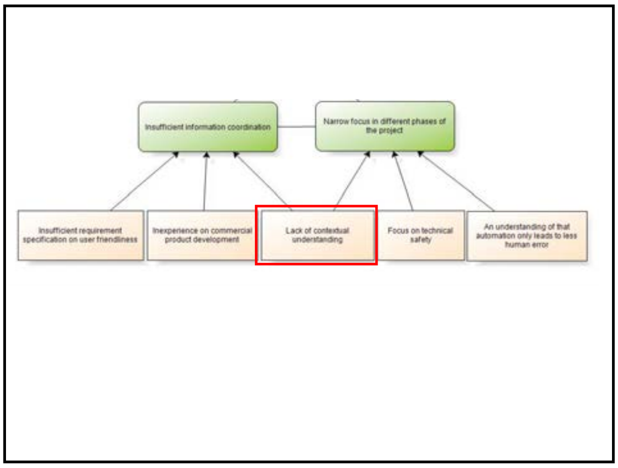
- The project group
  - different companies: operator, the main contractor, sub-contractors
  - dynamic: different members according to phases
  - changed leader during the process
- The engineer designer's team
  - customer, main contractor and several sub-contractors
- The technology in itself was a complex technology
- The end users defined in the project:
  - Divided in
    - mainly staff from the contractor company
    - partly drillers and supervisors offshore
- The end users as we defined:
  - Divided in:
    - the main operator from the contractor company
    - the drillers *and ass. drillers* from the company employing the drilling crew
    - the remaining drilling crew
    - the supervisors offshore from the operator/customer company

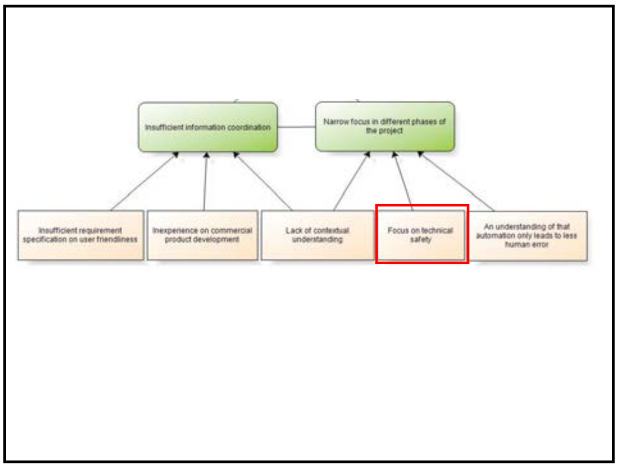


Effects of insufficient human factors and human reliability analyses during design phase.






Insufficient information coordination
Narrow focus in different phases of the project
Insufficient requirement specification on user friendliness
Inexperience on commercial product development
Lack of contextual understanding
Focus on technical safety
An understanding of that automation only leads to less human error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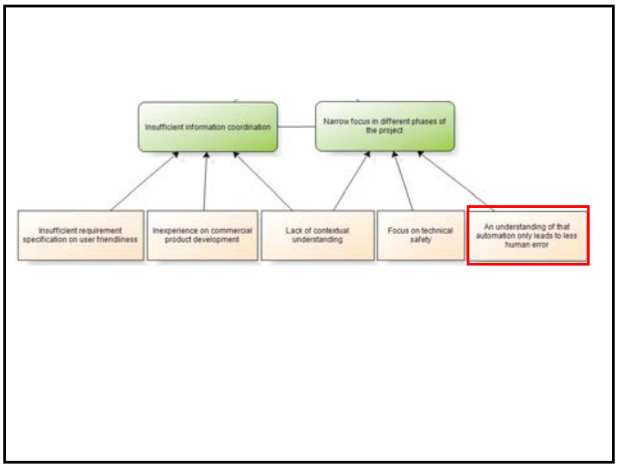
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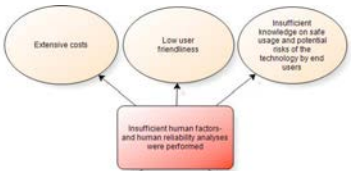
The outcome



- How could this happen?
  - Complexity
  - Lack of systematic guidelines on which analyses to perform and how to perform them
  - Non-questioning culture (trust)