Identification and Reduction of Risks in Remote Operations of Offshore Oil and Gas Installations

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Safety Challenges

■ Introduction - SINTEF

■ Background

■ Challenges

■ Proposed solutions – Further work

Technology for a better society

Our partners

- **The Norwegian University of Science and Technology, NTNU:**
  - 20 000 full-time students
  - 973 scientific employees

- **University of Oslo, UiO,
  Faculty of mathematics and natural sciences:**
  - 4500 full-time students
  - 518 scientific employees

NTNU and the SINTEF Group Collaboration in R & D

NTNU personnel working on SINTEF projects ⟷ SINTEF employees teach at NTNU

Joint use of laboratories and instruments

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Background

- Remote operations and remote control of offshore Oil and Gas installations is increasing in the North Sea.
    - The main motivation is the potential for operational cost reduction and increased income or yield from the fields, but also the reduced hazard exposure to humans.

- The supporting technology related to e-Operations is maturing and creating new possibilities.

- E-Operation and remote operations/remote control has become the new "Buzz-word" – internet connection is taking place at an increasing rate
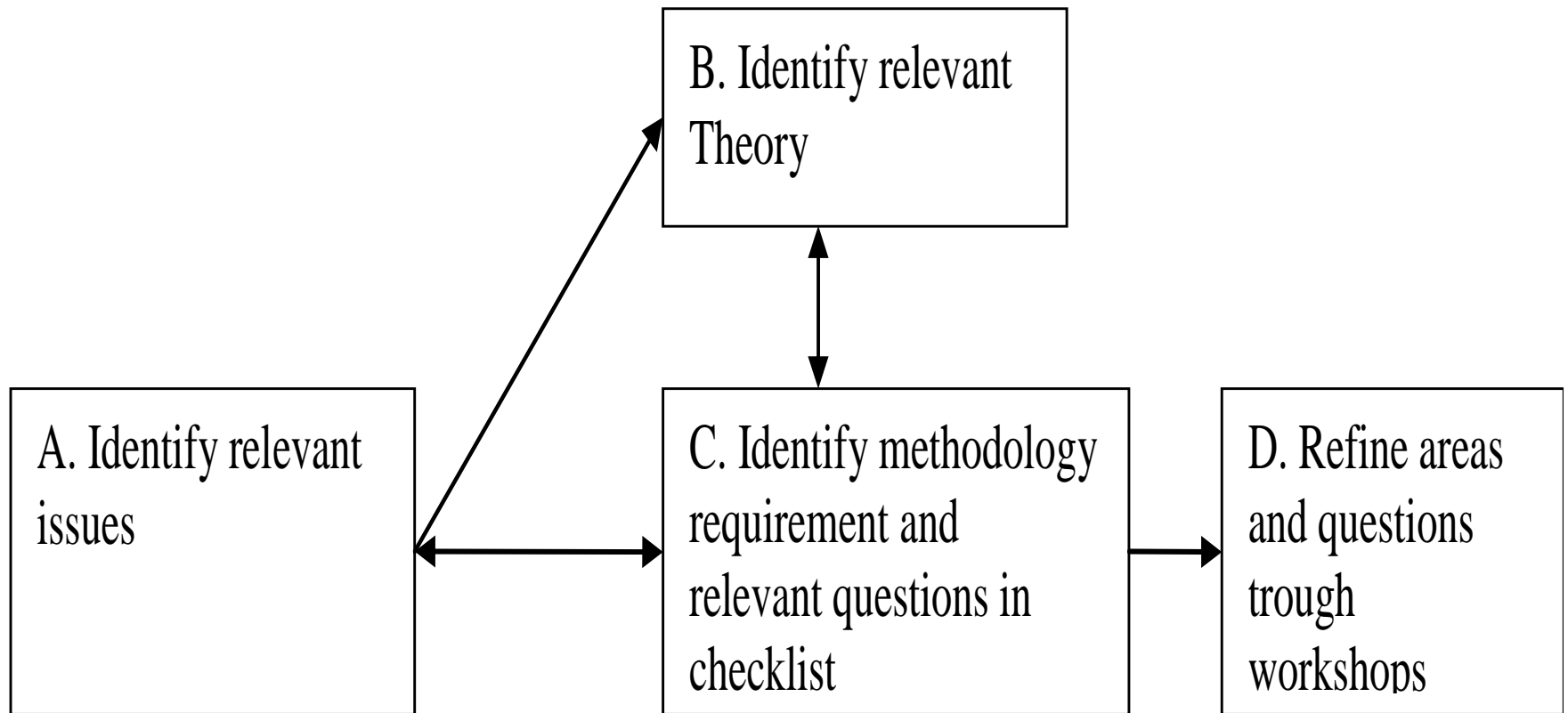
Definitions

■ **E-Operations:** The use of Information Technology to change work processes to improve decision-making, perform remote operations and move personnel (functions) from offshore to onshore – WhitePaper -38 (2003-2004)

■ Other terms being used:
  ■ Integrated Operations, E-Field, Field of the future

Definitions

- **Remote Support:** The operation is managed or operated offshore, but some sort of support is being given by onshore experts via teleconferencing, video, phone or radio.

- **Remote Monitoring:** The operation is managed or operated offshore, but some sort of monitoring is being performed by onshore experts.

- **Remote Control of Operations:** The operation is managed and operated remotely, from an onshore location.

Process

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Challenges

- Many different terms and definitions are being used in remote operations and remote control.
    - IEC 61508 - Functional Safety of Electrical, Electronic & Programmable Electronic Safety-Related Systems
    - Common Criteria, ISO 15408
    - IS 17799 *The ISO standard 17799 Information technology – Code of practices for information security management*, 2000

- Management of the change process when implementing remote operations and remote control has also been a challenge in the Oil & Gas industry
    - Failure rate of large ICT projects is between 50- 75%

- Remote operation increases the need for common situational knowledge, and ability to communicate clearly and efficiently in a geographically dispersed team –
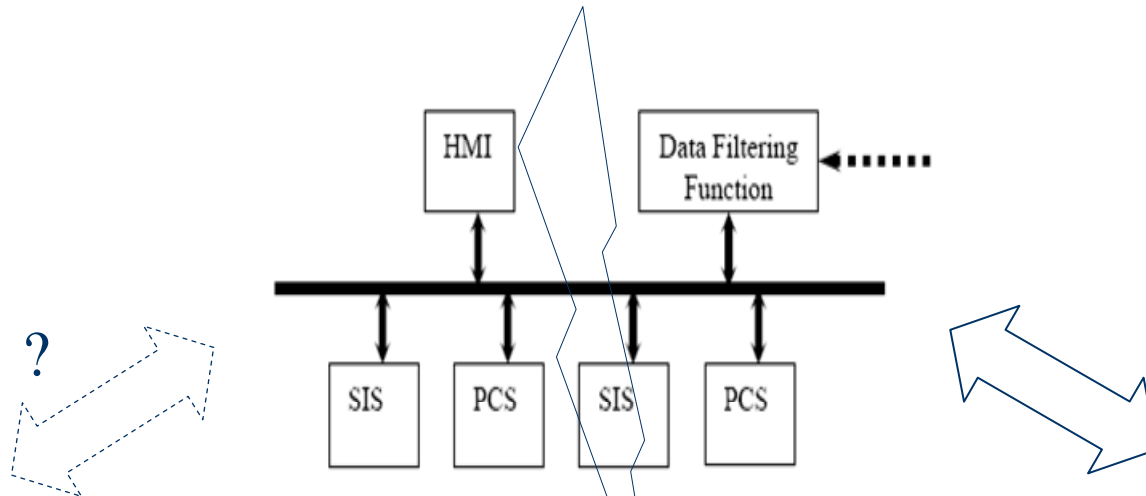   - Need for Common mental models and common situational awareness
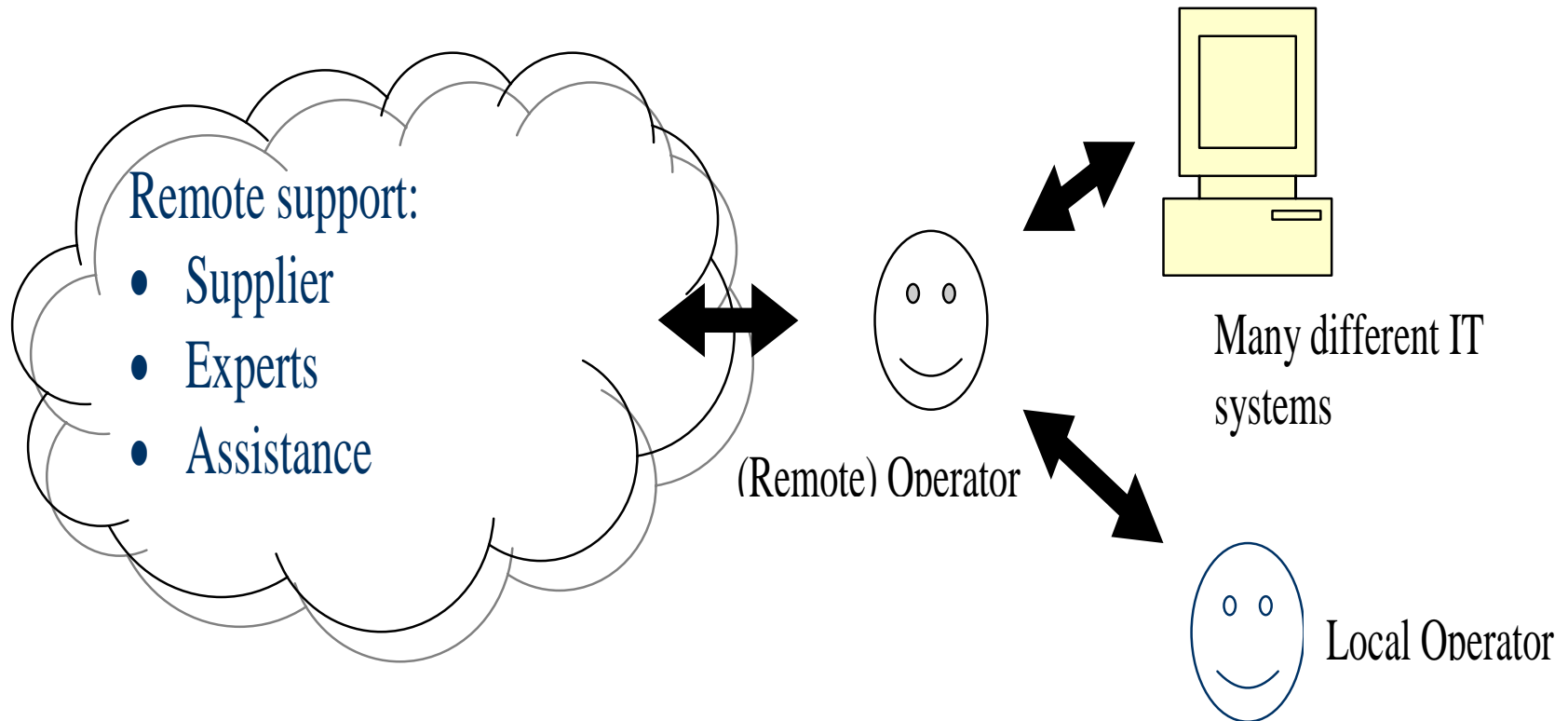
Important standards

Communication challenge – Human Factors

Remote support:
- Supplier
- Experts
- Assistance

(Remote) Operator

Many different IT systems

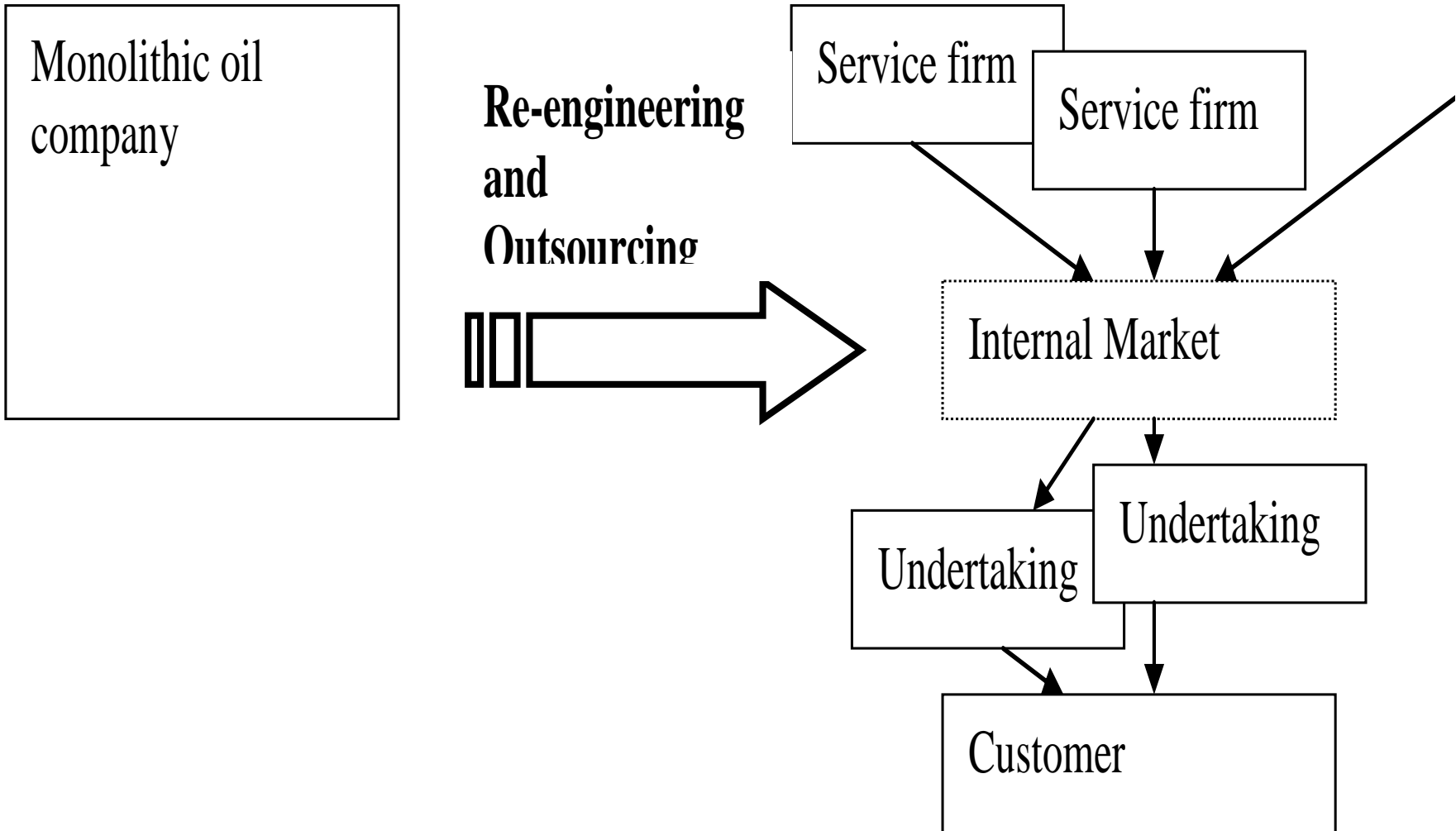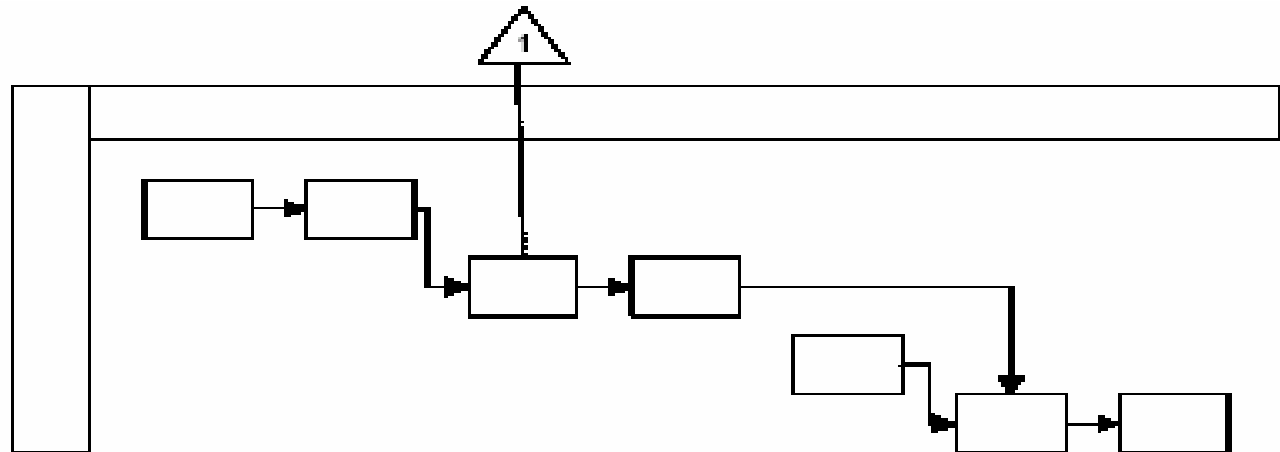Local Operator

Challenges

- eField of the future - Fragmented responsibility in a network of cooperating firms and different "mental models"

- Internet security – Safety and Security when allowing Internet access

- Increased reliance on ICT systems leads to the need for more secure and robust ICT solutions and robust emergency shutdown systems

There is a network of cooperating firms in your future

Monolithic oil company

Re-engineering and Outsourcing

Service firm

Service firm

Internal Market

Undertaking

Undertaking

Customer

Safety Barrier Analysis
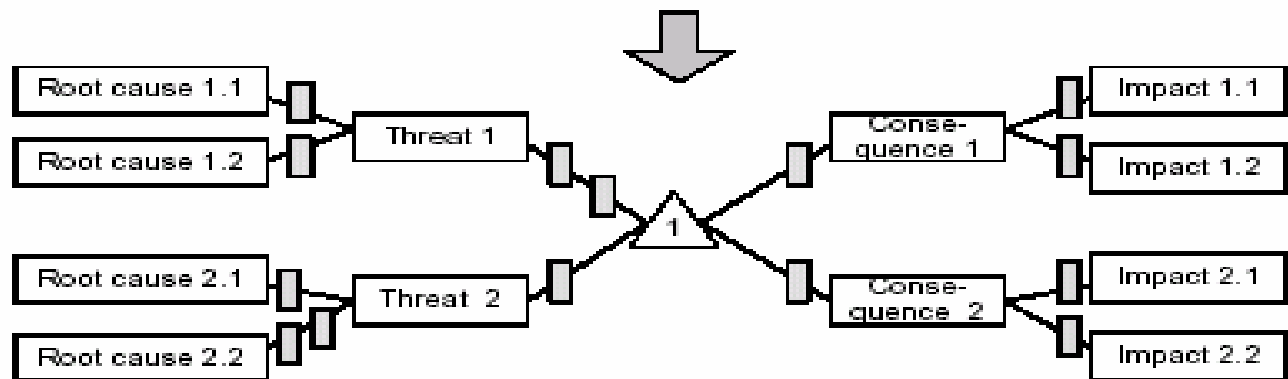

Step 1
Scenario Analysis with STEP. Identify weak ponits.

Step 2

Analyse the weak points acording to Detection, Diagnosis, Decision making and Action in CRIOP Scenario Analysis

Step 3

Root cause 1.1
Root cause 1.2
Threat 1
Conse-quence 1
Impact 1.1
Impact 1.2

Root cause 2.1
Root cause 2.2
Threat 2
Conse-quence 2
Impact 2.1
Impact 2.2

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Internet Security

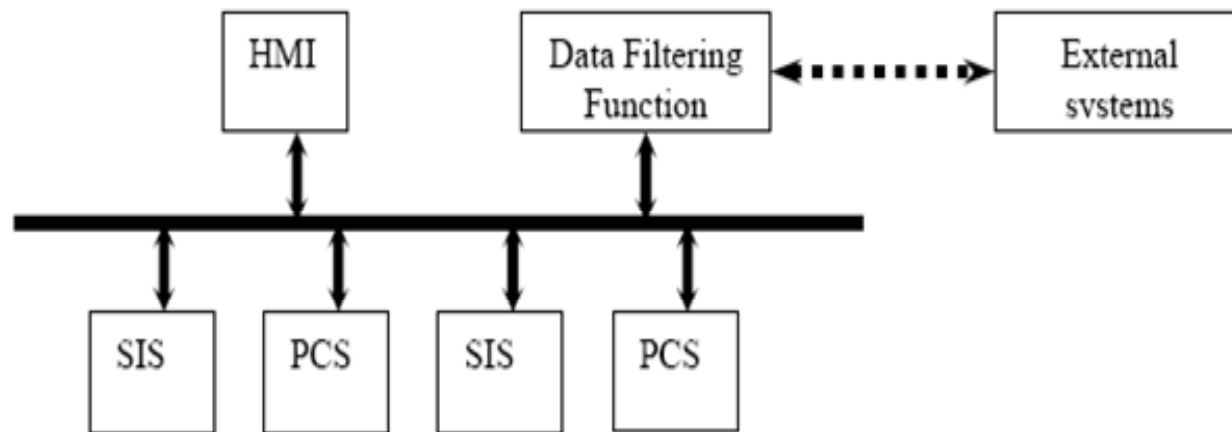## G.3.1.1 Connection to external systems via a Data Filtering Function

Figure G.3   Connection to external systems via a data filtering function

The Data Filtering Function may e.g. be an integrated Information Management System (IMS) or one or more PCS computers (nodes) and thus be part of the PCS.

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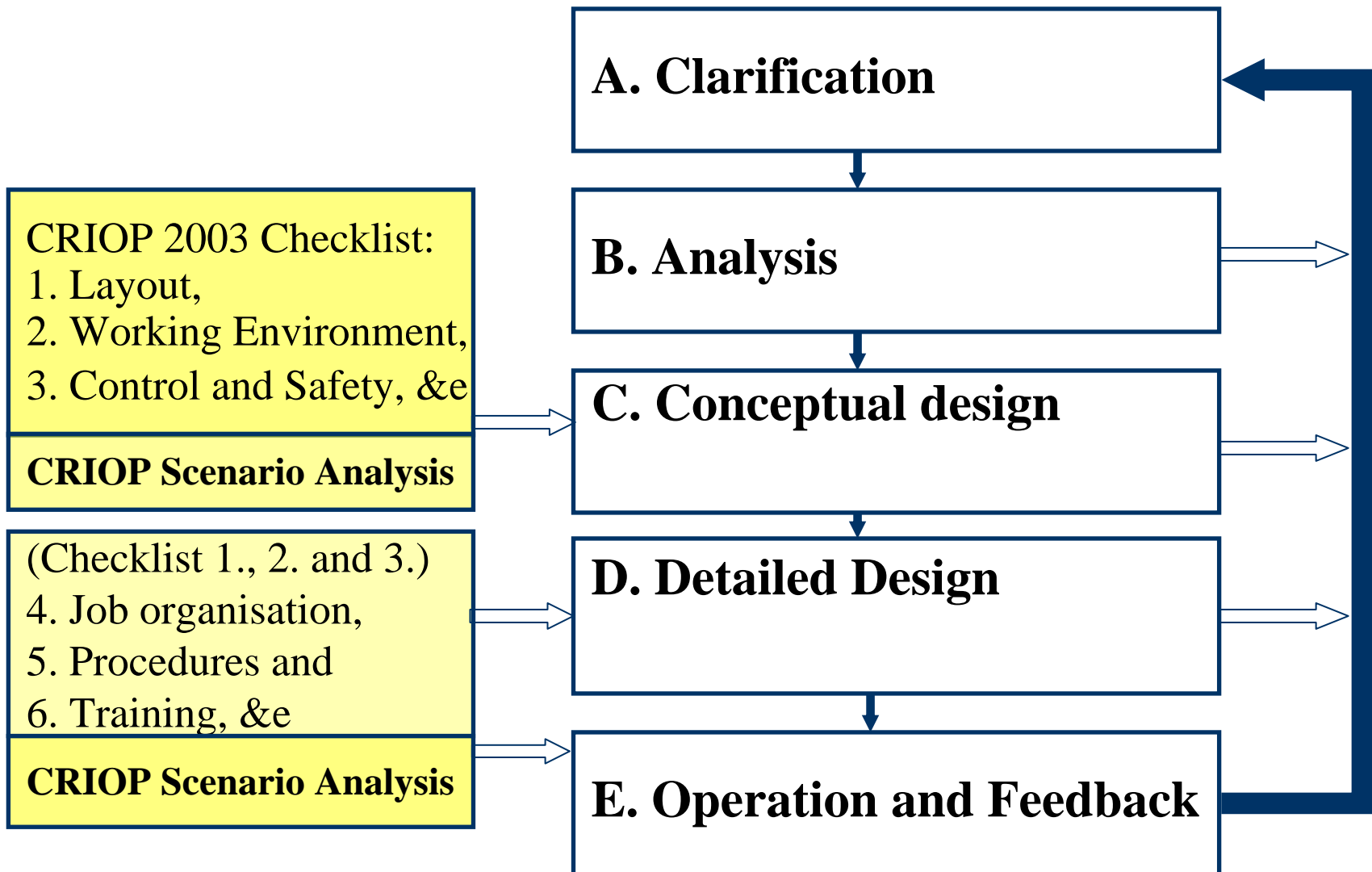
Proposed solutions

- ■ Establishment of "Best Practice" Checklist related to e-Operations integrated in a methodology used in Oil & Gas industry (CRIOP)

- ■ Enacting Scenarios in CRIOP to identify and resolve problems in a network of cooperating firms
  - ■ Check common "mental models" and use of common standards

CRIOP (Crisis Intervention in Offshore Production)

- Goal: CRIOP is a methodology used to verify and validate the ability of a control centre to safely and effectively handle all modes of operations
    - Control Centre : Offshore/ On-shore, Remote operation, Remote support

- CRIOP has been developed by the Norwegian Oil & Gas industry and has been used since 1990 with great success
    - 2 – 5 workday effort
    - Significant revision in 2004

CRIOP integrated in ISO 11064
- Ergonomic design of control centres

CRIOP 2003 Checklist:
1. Layout,
2. Working Environment,
3. Control and Safety, &e

CRIOP Scenario Analysis

(Checklist 1., 2. and 3.)
4. Job organisation,
5. Procedures and
6. Training, &e

CRIOP Scenario Analysis

A. Clarification

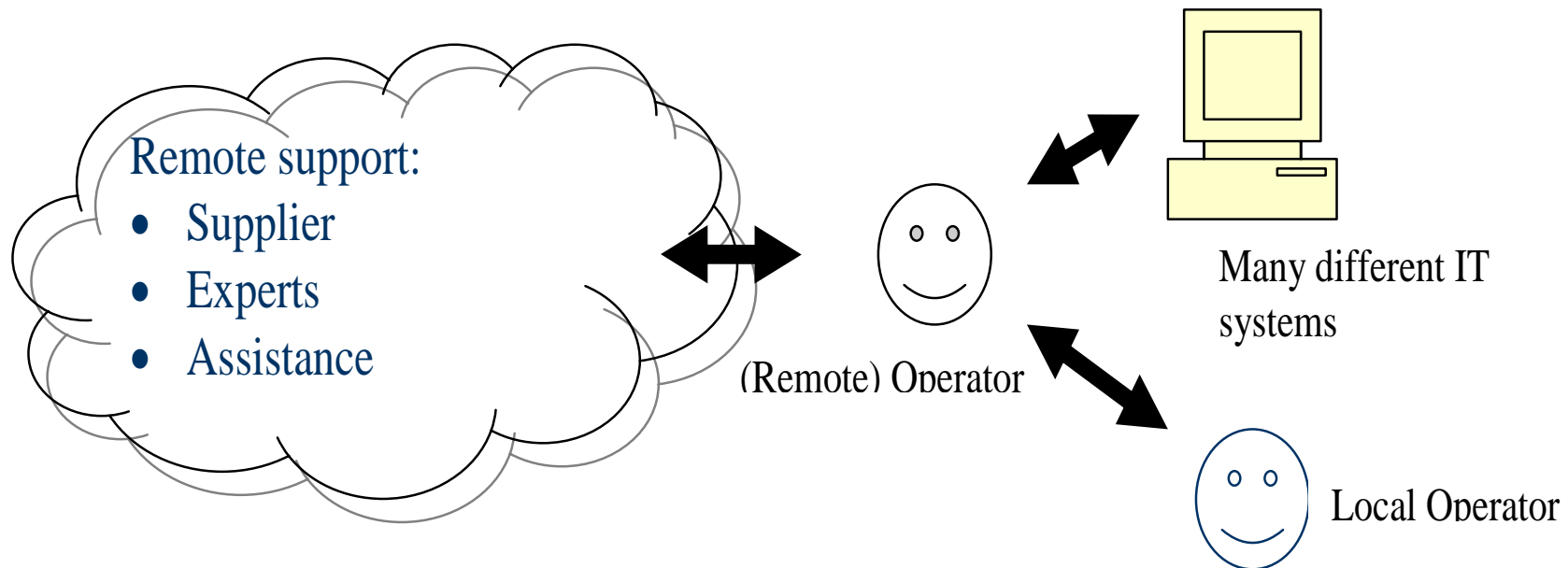**B. Analysis**

C. Conceptual design

D. Detailed Design

E. Operation and Feedback

Common Mental Models/ Industry standardisation

Common mental models between the key actors in remote operations:
- ***situational knowledge***
- *knowledge about each participants **roles and responsibilities***
- *knowledge about operating procedures, termed **procedural knowledge***
- ***Cultural knowledge** (Common goals, beliefs, norms)*

Remote support:
- Supplier
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(Remote) Operator

Many different IT systems

Local Operator

Some key areas to be explored in checklist

1. *Have- several relevant and critical scenarios been performed and analysed to ensure that the associated scenarios can be handled in a safe way?*

2. *Has the system been designed to support common mental models between all the key actors in remote operations, including common:*

   - ***situational knowledge***
   - *knowledge about each participants **roles and responsibilities***
   - *knowledge about standard operating procedures, termed **procedural knowledge***
   - ***Cultural knowledge** (Common goals, beliefs, norms)*

3. *Are the operators trained in cooperating with remote experts (engineers) in solving actual operating problems?*

4. *Has a safety and security standard been established in accordance with best practice from ISO 17799?*

Some References

- Safety and security at SINTEF www.sintef.no
  - http://www.risikoforsk.no/

- Reliability, Safety and Security Studies http://www.ntnu.no/ross/
  - at the Norwegian University of Science and Technology (NTNU) in Trondheim, Norway

- CRIOP http://www.criop.sintef.no/
  - CRIOP is the leading methodology to verify and validate the ability of a control center to safely and effectively handle all modes of operations