Safety rule modifications
in the Norwegian railway system

Helene Cecilie Blakstad

SINTEF Technology and Society

Presentation overview

1. Background
2. Research approach and principles
3. Results of studied cases
4. Implications
5. Conclusions

The hierarchical approach

1. Hierarchical rule system
   a. Safety management or outcome oriented rules
   b. Mixed solutions or rules for decision making
   c. Prescriptive rules
2. Often associated with positions in hierarchies in the organizational or safety management systems
3. Predominantly deductive approach to rule development, i.e. top down

The risk based approach

- Focus plant and regulatory attention by analytical insights derived from probalistic safety- or risk assessments
- More or less in combination with
  - Deterministic principles
  - Operating experience

  i.e. risk based or risk informed

(Derived from Chapman & Dimitrijevic, 1999, p 251)

Theoretical and practical challenges

- Different types of rules require different contexts:
  1. Relationship between rules and control principles
  2. Requirements for time to think
  3. Relationship between rules and coordination
  4. Requirements upon rule-imposers' and rule-followers' railway knowledge
- The top down approach and use of risk analyses:
  1. How to combine the top down approach and risk analyses with existing prescriptive and predominantly experience-based rule traditions?
  2. Democratic elements require some "bottom up"

The Norwegian railway system

- Modification tradition with:
  - Experience based prescriptive rules
  - Directed at the operative staff
  - Emphasis upon more or less explicit, collective and rather experience based railway knowledge,

    i.e knowledge of the system's technology, activities and interactions
- Development towards increased emphasis upon:
  - Risk management and outcome oriented rules
  - Use of risk analyses as fundament for rules

Opportunities for case studies:

Traffic rule case:

- Modifying ”traffic rules”
- Intentions: Think new
  - From prescriptive action rules
    to outcome oriented rules; goal oriented rules
  - Base the rule development on risk analyses

Maintenance rule cases:

(Signal, Power supply and Superstructure)

- Modifying ”maintenance rules” for the infrastructure
- Intentions: Think new
  - From detailed prescriptive action/state rules
    to outcome oriented rules; triggering requirements
  - Base the rule development on risk analyses

Research question:

How did the Norwegian railway system respond to new requirements for safety rule modifications?

Research approach and principles

- Explorative and qualitative approach
- Case study design:
  - Four cases of rule modification
- Information gathering:
  - Interviews of 41 people involved in the processes
  - Studies of selected documents from the cases
  - Four meetings
- Analyses inspired by Grounded theory
  - An iterative process between data-collection, development of analytic tools and results

A hierarchical approach?

All cases:

- Tried to develop outcome oriented rules with a “top down” strategy
- Evaluated the strategy and the rule principle
  - Railway knowledge served as reference
- Abandoned the approach:
  - Outcome oriented rules were not developed from risk analyses
  - Prescriptive rules appeared remarkable persistent

The alternative solutions

All cases:

- Developed new rules on the background of existing prescriptive rules and railway knowledge:
  - a bottom up approach
  - knowledge associated with existing rules brought forth
- Used risk analyses as supplement if available
- Wanted combined rule solutions. However,
  - The Traffic rule case stayed with prescriptive rules
  - The Maintenance rule cases made more use of prescriptive rules than expected

The solutions are much supported by theory

A risk based approach?

Differences between the cases:

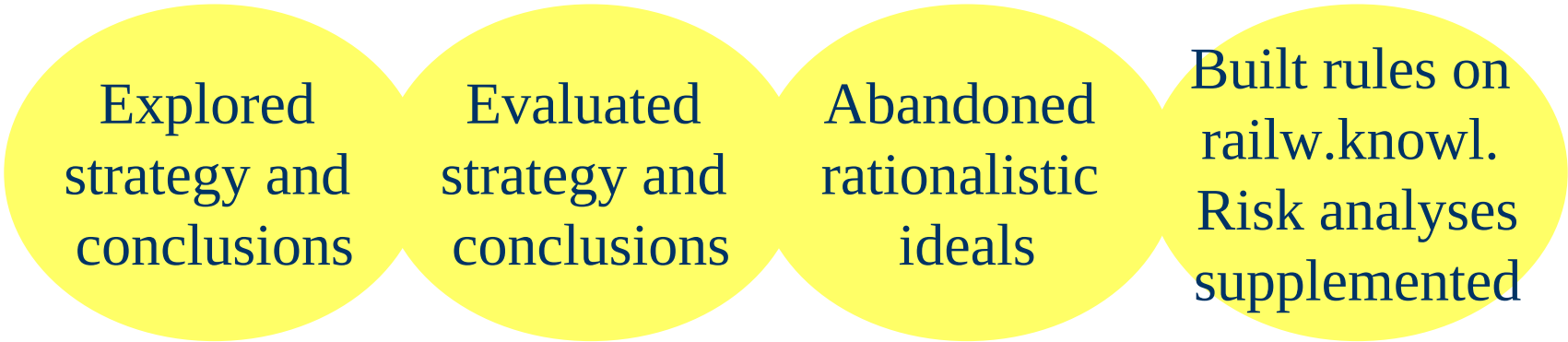
- The four cases demonstrated four solutions for combining risk analyses and rule development:
  1. Iterative and interactive
  2. Sequential
  3. Stepwise and iterative
  4. Validating
- The four solutions gave the risk analyses different functions in the modification work:
  - Decision support
  - Ensuring quality
  - Validating old or new rules and associated knowledge

Common features

There were also similarities between the cases:

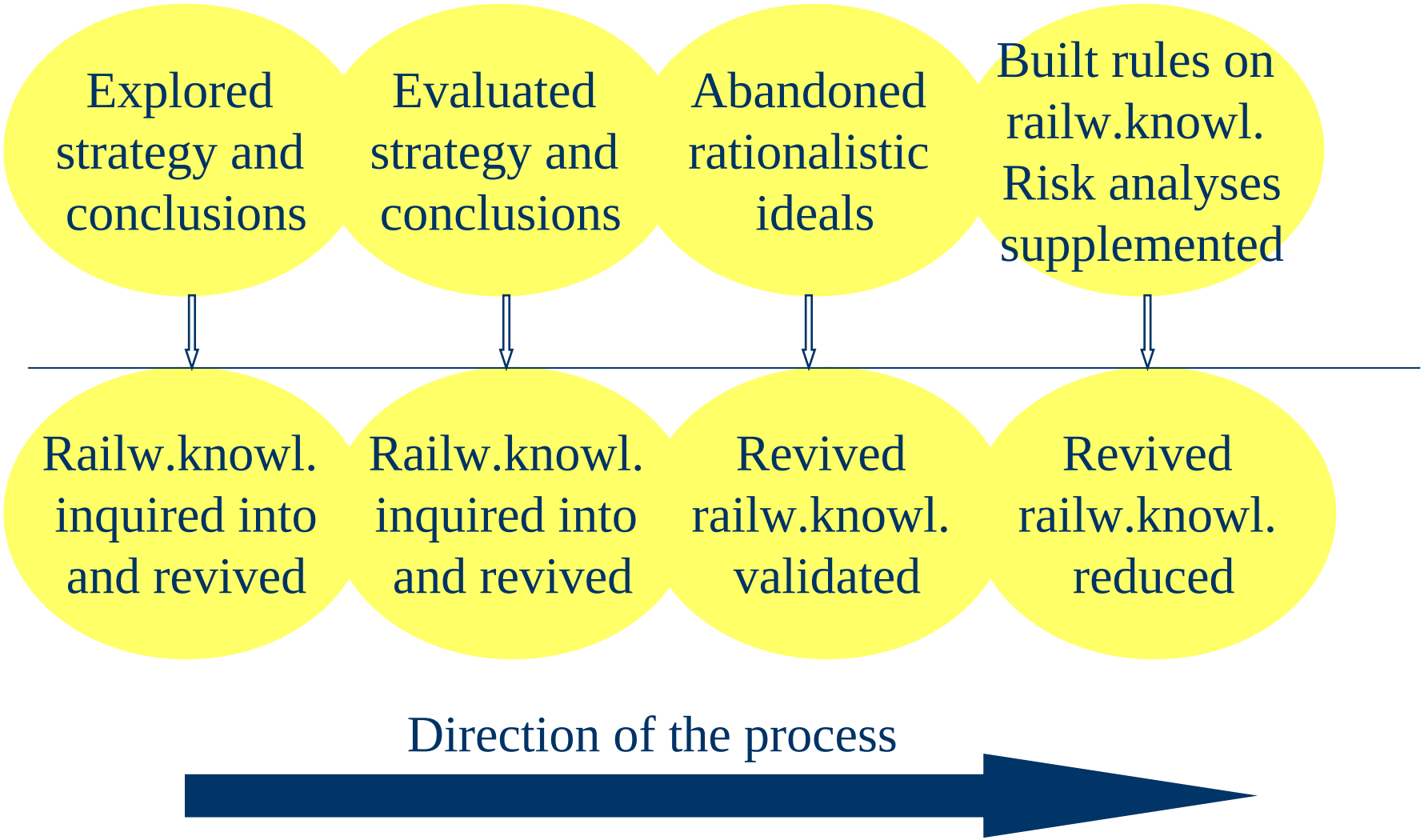
1. Risk analyses used as a supplement to the existing modification tradition, i.e. risk informed
2. Risk analytic results evaluated with railway knowledge as reference. Known risks covered?
3. If contradictions occurred, risk analyses became reviewed and conflicts resolved.
4. Confidence in risk analytic results depended upon:
   - Competency of the risk analyzers
   - Suitability of settled scopes and preconditions for the analyses
   - Appropriateness of risk analytic methods

The strategy of “Reverse invention”



Direction of the process

Influence upon railway knowledge



Practical implications

1. Rule principles need to be judged with respect to characteristics of their context
2. Requirements of outcome oriented rules can be met with a “bottom up” approach
3. Risk analyses can be applied differently and serve different functions
4. Confidence in new approaches depends on a number of factors that need to be taken into consideration
5. New approaches can revive and develop organizational knowledge, but also endanger it

Main conclusions

1. Ideals of hierarchical and risk based approaches were abandoned
2. Instead, the cases applied a strategy of “Reverse invention”
3. Risk analyses
   - Were applied differently
   - Served different functions
4. The cases wanted to combine different rule solutions but existing railway knowledge, including prescriptive rules, appeared remarkable persistent
5. Railway knowledge became revived
6. Revived railway knowledge became reduced
7. The results have practical implications