

LQI Symposium 2012

DTU Lyngby, Denmark

LQI - The marginal life saving cost principle in engineering practice

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ARAB SPRING

AGING SOCIETY

DEVELOPMENT OF INTEREST RATES

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ENERGY TURNAROUND

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Introduction

- Economic development and future scenarios will lead to less resources in society.
- Competition on resources will become more relevant for public and private investors.
- Risk-based decision-making in society (e.g. health, engineering) will become more relevant.
- Linear cutbacks of investments will not help in solving future challenges.



Introduction

Public/private decision makers and investors intend to provide a maximum level of personal safety:

- ethical issues
- legal issues (strict liability)
- attraction of media
- business interruption
- other indirect losses/consequences





Introduction

In general, decision makers are not willing to accept any casualties in their area of responsibility.

They prefer to deal with a deterministic world.

However, there is no (deterministic) concept to avoid any causality and fatality resulting from human activity.

→ Risk-based decision-making is regarded as the second best option.



Introduction

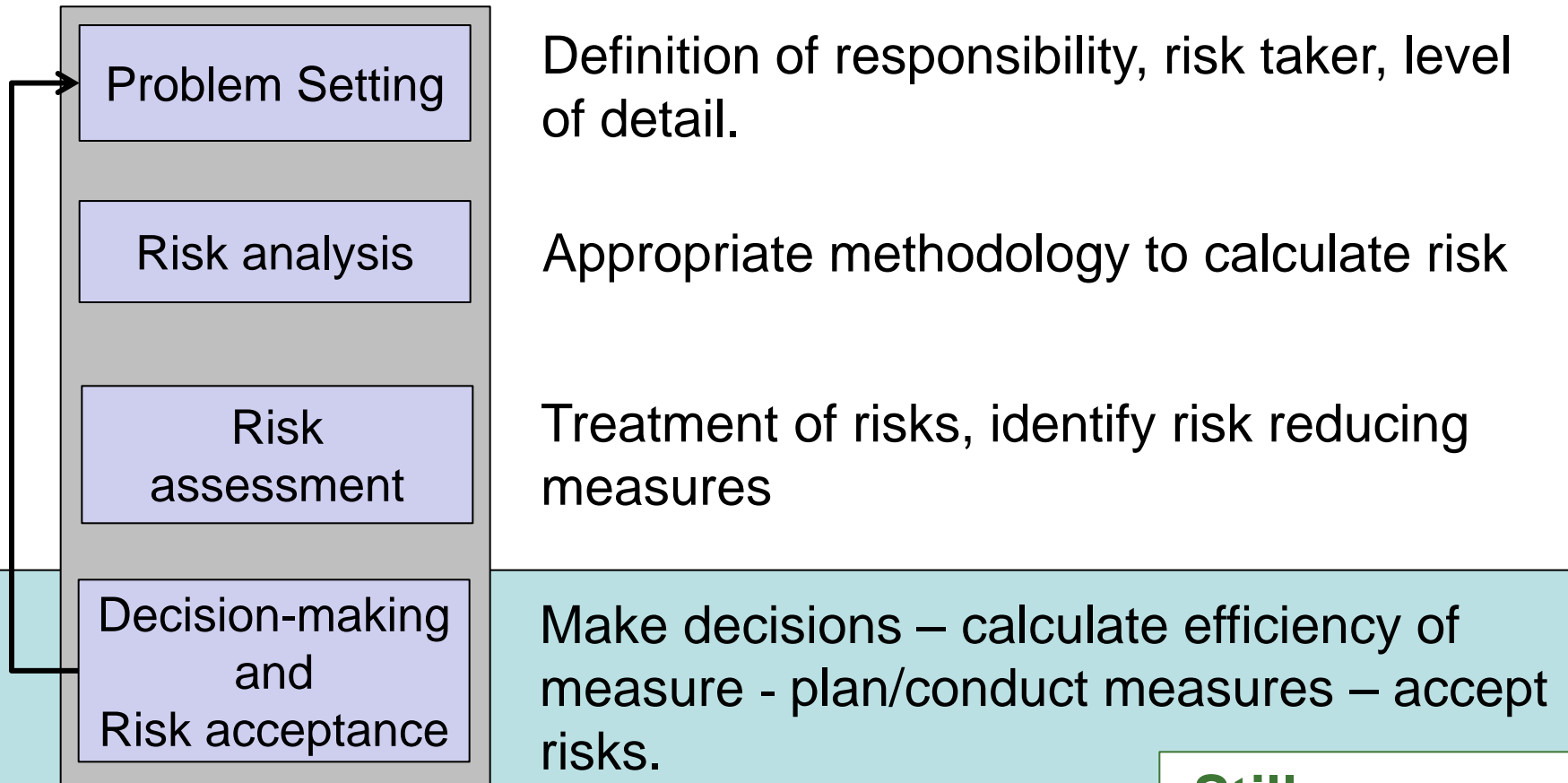
Driving forces to use risk-based methodologies:

1. Justify investments into safety with existing portfolio of assets/new assets and use existing budget in an efficient manner.
2. Comply with principle of proportionality of measures and avoid damage through gross negligence.





The decision-making process



Still very poor



Decision-making
and
Risk acceptance

Make decisions – calculate efficiency of
measure - plan/conduct measures – accept
risks.

Still very poor

development

Use the marginal cost principle MRS?

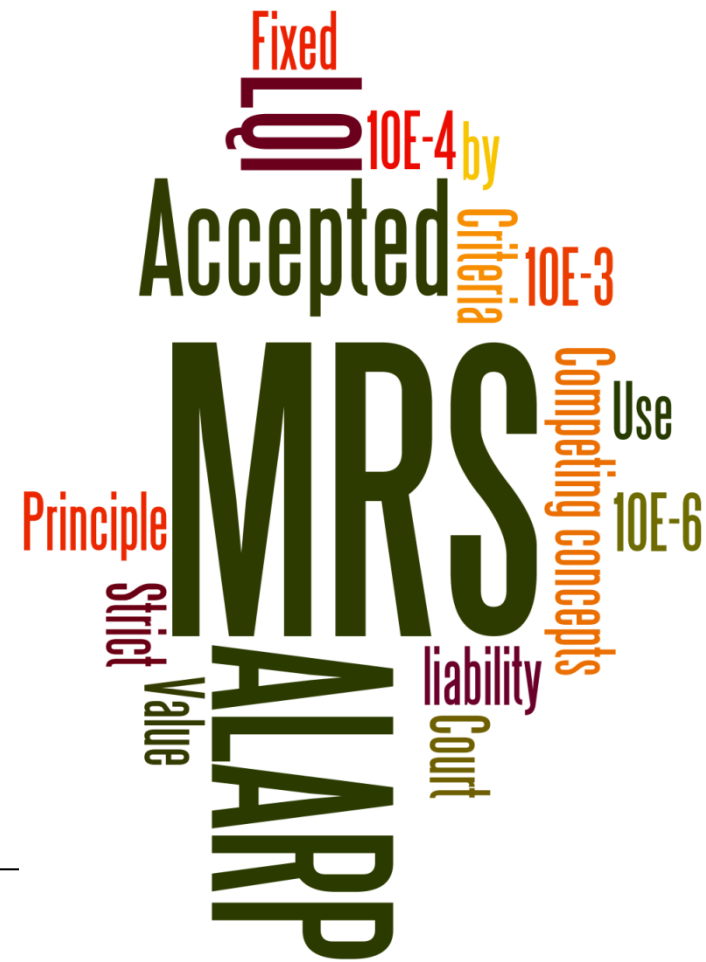
Use a fixed acceptance criteria?

Use a combination (ALARP)?

Accepted by court in case of an event?

Value of MRS?

Time development?





Decision-making
and
Risk acceptance

Make decisions – calculate efficiency of
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Still very poor

Can the LQI be considered **best practice**?

Best practice means:

1. Regarded as scientifically correct by the research community
2. Widely known by experts in practice
3. Tested and proved in practice



Marginal life saving costs in Engineering (Some examples from Switzerland)

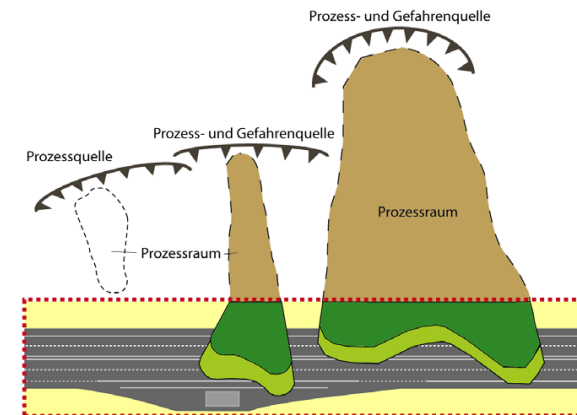
FOEN: EconoMe

Tool for decision-making with regard to protection structures. Obligatory for new project.
MRS: 5 Mio. CHF (no ref.)



FEDRO: RiKo

Methodology for the decision-making for protecting roads with regard to natural hazards.
MRS 5 Mio. CHF (no ref.)





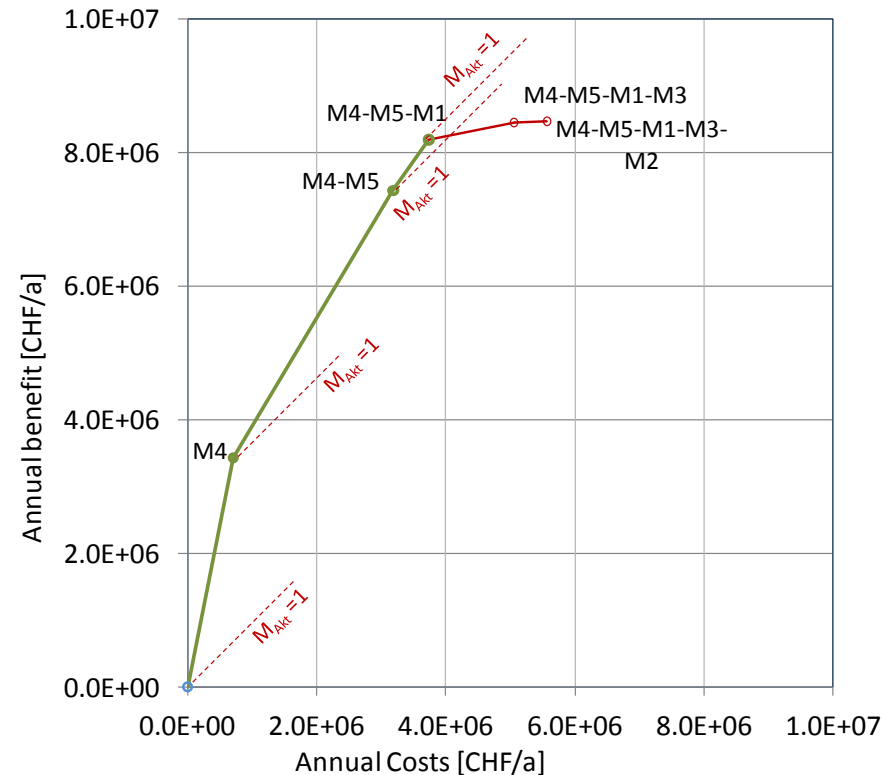
Marginal life saving costs in Engineering (Some examples from Switzerland)

FEDRO: Tunnel Risk Assessment

Methodology for risk informed decision making to enhance personal safety in roadway tunnels.

ALARP principle will be used

MRS – Value to be defined



Marginal life saving costs in Engineering (Some examples from Switzerland)

Private Investor

Problem setting:

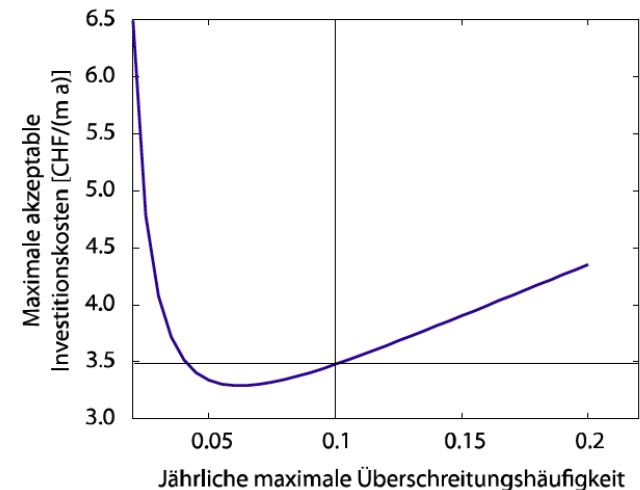
Is a specific landscape safe enough to be used as a sport facility?

Solution:

What is the maximum reasonable investment costs for reducing the risk to zero.

MRS: 5 Mio. (value based on LQI)

Showed that only organisational measures are reasonable – safe enough without structural measures.





Marginal life saving costs in Engineering (Some examples from Switzerland)

Private Company

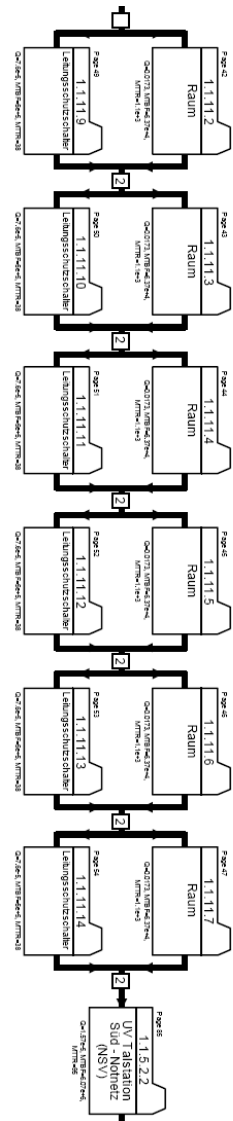
Problem setting:

Does a planned fire fighting and protection system in an underground structure provide sufficient safety?

Solution:

Modelling of a complex system including ventilation systems, sprinkler, power supply and locking and find cost efficient measures for the improvement.

MRS 5 Mio. CHF (no ref.)





Lessons learned

- The marginal life saving principle is widely used in Switzerland.
- Large investments are justified by using the principle.
- No code or standard exists on the marginal cost principle (Even HSE just “take” a value of 1 mio. £).
- Decision maker accept marginal cost principle – but feel still uncomfortable (lack of acceptance).
- Values are based on other studies (cross references not rational).
- Acceptance concepts in general are not well known and understood.
- A sound treatment of casualties is needed.



Needs of decision makers considering life safety aspects

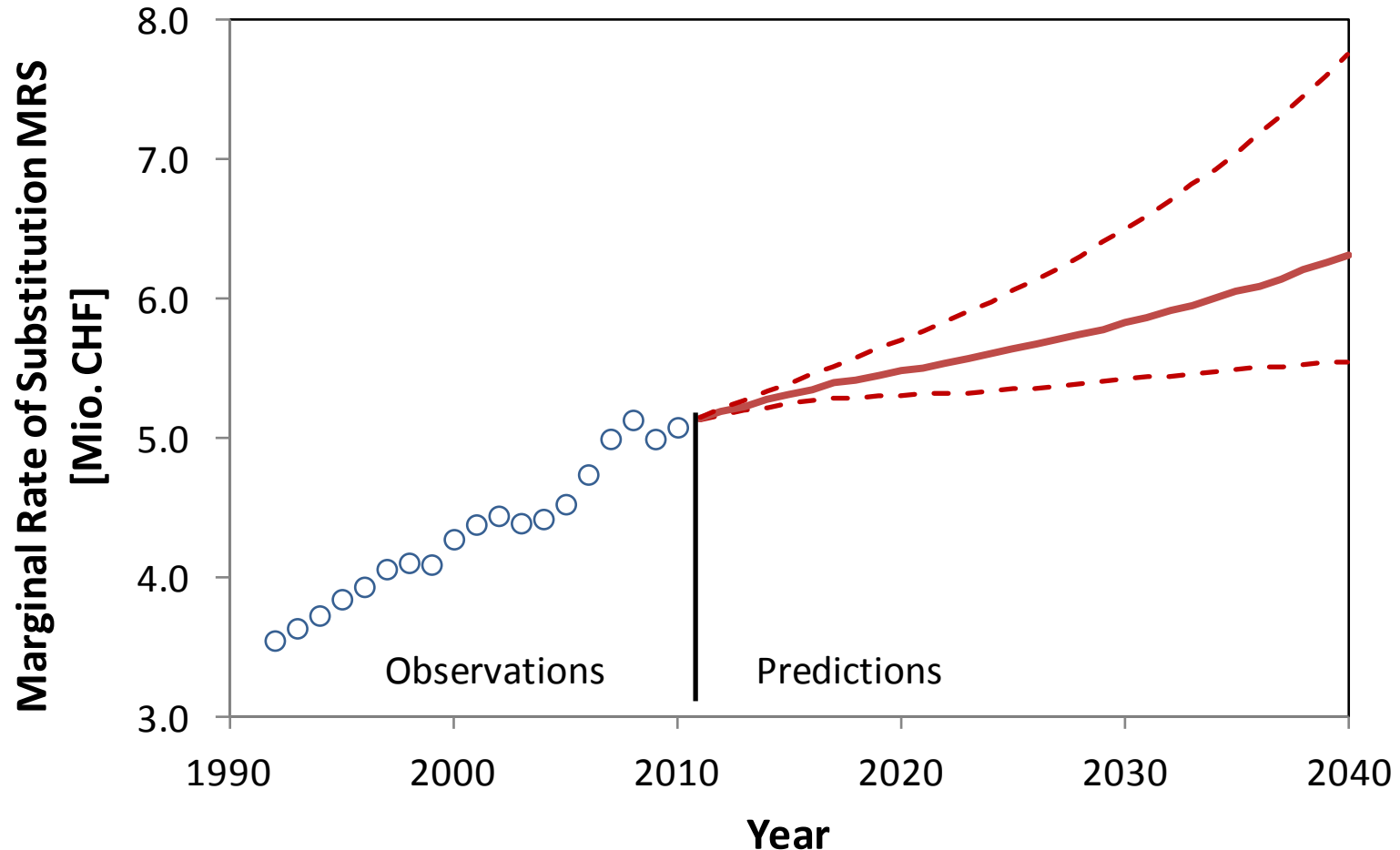
- Uniform value which can be used in any application
- Reference with a legal character (code or standard) :
 - Based on economic principles
 - Possibility to predict the value in the future

But:

Decision makers are not interested in concepts → Type of approach is unimportant, should reflect best practice.

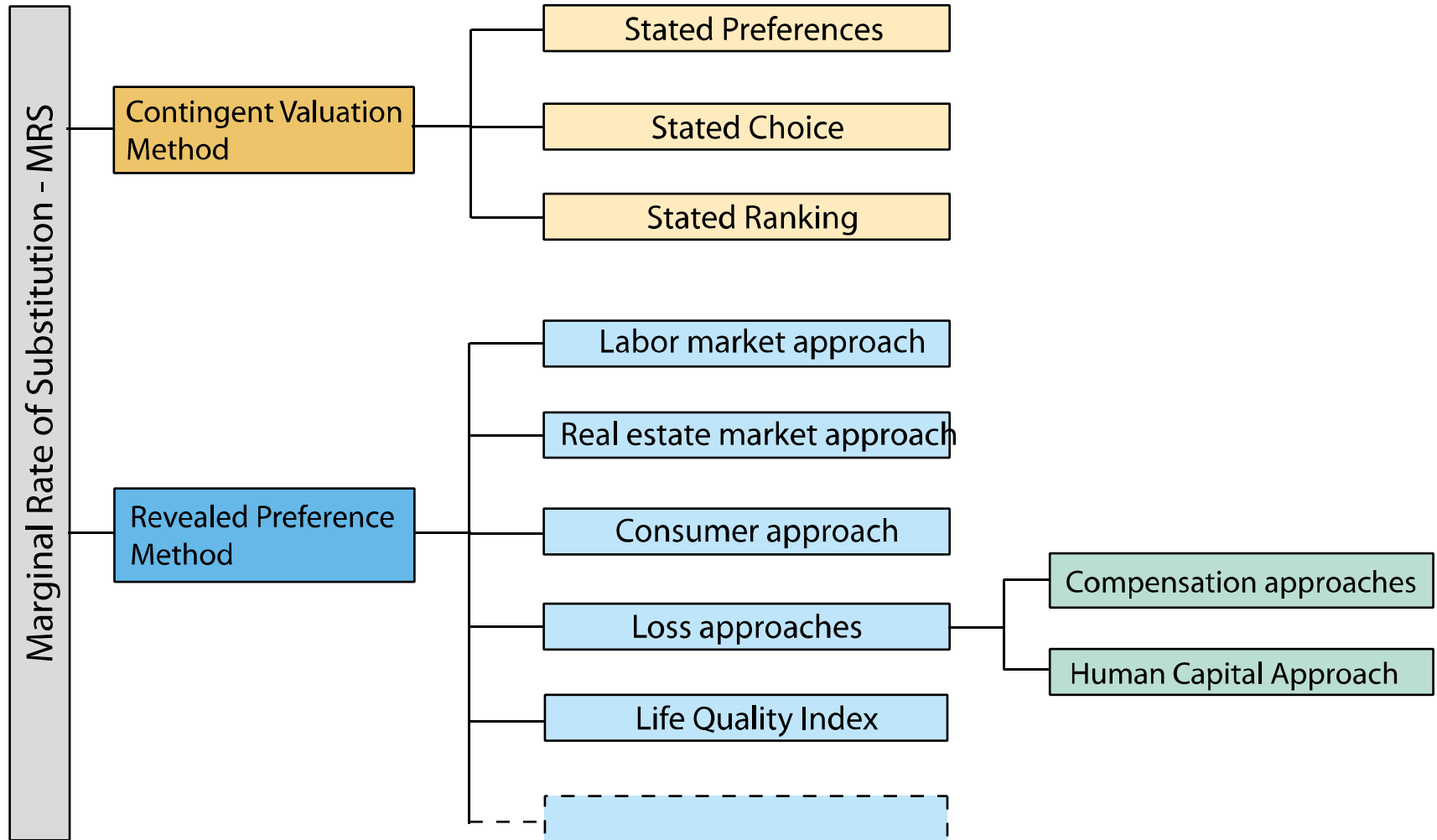


Development of the MRS based on the LQI for different Szenarios in Switzerland





MRS can be derived from different general approaches





Life Quality Index

Advantages

- Scientific foundation
- Based on revealed preferences
- Based on simple economic values
- Values easily reproducible
- Same philosophy can be applied in different national economies
- Transparency

Disadvantages

- Life quality index – Wording is not appreciated by decision makers
- Concept difficult to explain in an elevator pitch
- Competing with other approaches



Marginal cost principle and law

Risk-based criminal law

- Not forbidden to impose a risk of live with normal magnitude
- Responsibility and risk transition
- Prescription that a risk has to be reduced as much as reasonably possible (duty of care)
- Risk assessment combined with decision making help to avoid damage by gross negligence

Risk-based civil law

- liability for damages remains
- appraisal of reasonability of investments can differ from criminal law



Conclusions

- Risk-based decision-making with regard to life safety is used in engineering practices
- Decision makers still feel uncomfortable with the existing approaches due to the lack of best practices
- Risk-based concepts are generally in line with the criminal law/civil law (in Europe)
- A legal basis need to be developed (e.g. Eurocode) for the acceptance criteria and for the MRS values
- The LQI should/could be the basic principle

Thank you for your kind attention!

| Questions | Remarks | Comments |

