

Proposed framework for decision-making processes

The long-term **governance**¹ of radioactive waste is a complex socio-technical issue. The disposition of radioactive waste is decided on ethical grounds, having to take into account a variety of other **dimensions** (society, economy, ecology, politics, time, space, and technology). Thereto, a study of variants is required. Decision theory, in principle, takes diverse **options** as a starting point being at the basis of a decision.

Via decisions, possibilities to act or alternatives become actions, either active or passive. “**Deciding**” consequently encompasses two things: first, a *selection of alternatives* during a mental phase, secondly, an elicitation and *implementation* of will during a phase of realisation². Principally, decisional problems are informational problems; complete information on an issue would make a debate on deciding superfluous since there would be no deviation from the initial/factual state to the final/target state – there would not be any **problem** to solve (see Figure 1).

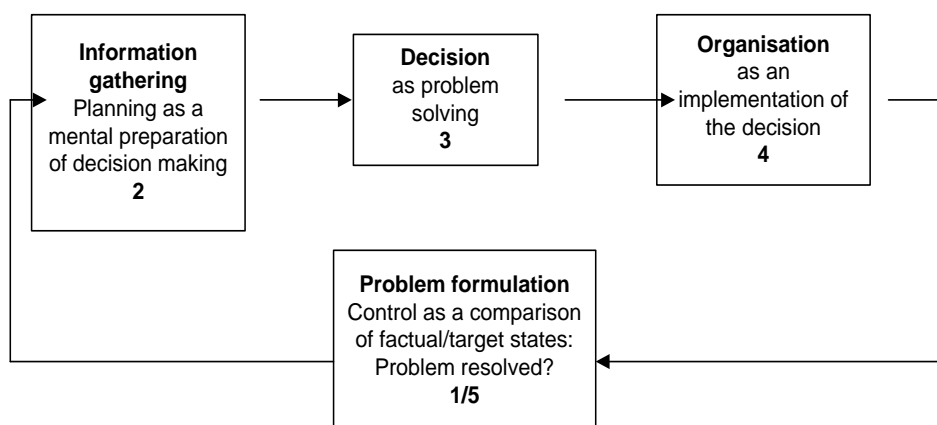


Figure 1: Decisions inherently are process-related. They may be visualised in the feedback model of an institution. It is important to link the iterative and cyclic decision-making process with the loop of **Problem formulation** (relation of factual/target states, 1), **Information gathering** (2), **Decision** (“first” problem solving, 3), **implementation** (“**Organisation**”, 4), and **Control** (eventually “second” problem solving, 5).

But if the information is incomplete, even variable, the question is not just what to do or not to do but whether additional information should be obtained or not. Aside of the issue of need for decision on actions there is the need for decision on information. **Information** is purpose-oriented **knowledge** in a decisional situation aimed at the future; it serves to reduce the decider’s uncertainty on what will actually happen in the future.

Deciding is not just the preference of an option; in decision making one has to deal with the following questions:

- How is sufficient knowledge collected? (Figure 2)
- How to judge in the presence of **uncertainty**?
- How to integrate individual **values**? (discourse on dimensions, see above)
- How to assess the potential implications and **side effects**?
- How are the options **perceived**?

¹ **Governance** is more than management and denotes, adapted according to the European White paper on “European Governance “rules, processes and behaviour that affect the way in which powers are exercised ... particularly as regards openness, participation, accountability, effectiveness and coherence” (2001, p. 8).

² It is assumed that “**judgement**” is followed by “**choice**”, a proposition debated in social psychology. Decision science usually assumes that decisions actually are taken.

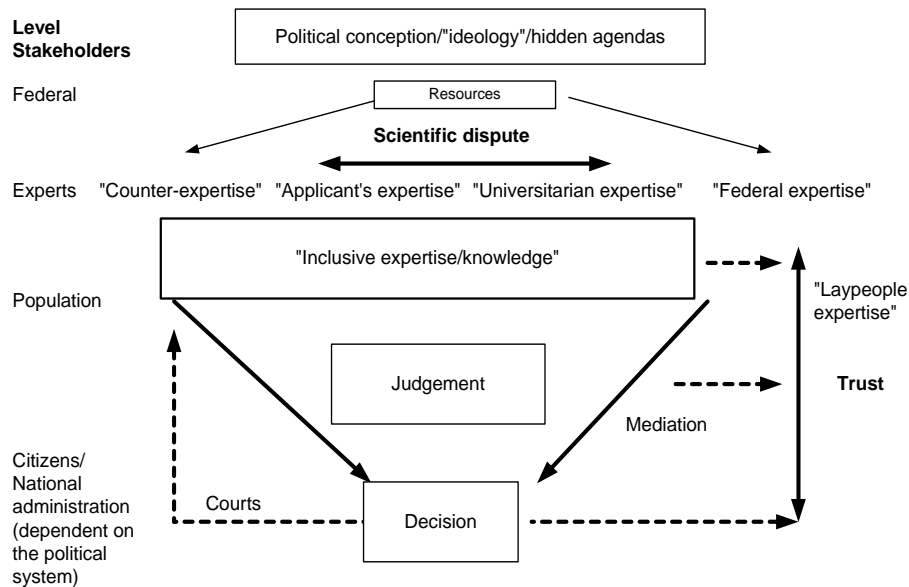


Figure 2: Transfer of knowledge with respect to decision (and implementation). The system is held together by a transparent, traceable scientific-technical (and societal) discourse, by trust in the stakeholders and a common understanding of the political conception: sustainability of waste disposition, passive safety combined with control and retrievability (or another set). A **stepwise and recursive procedure** should ensure the quality of expertise and decisions.

Decision making, thus, is on the **process** of deciding, the **judgement** made, the **choice** taken and, ideally, the decision **implemented**.

With complex issues like the present one, mostly **phased** collective decisions are necessary which line up in, ideally iterative, **partial decisions** over a long period of time (Figure 3).

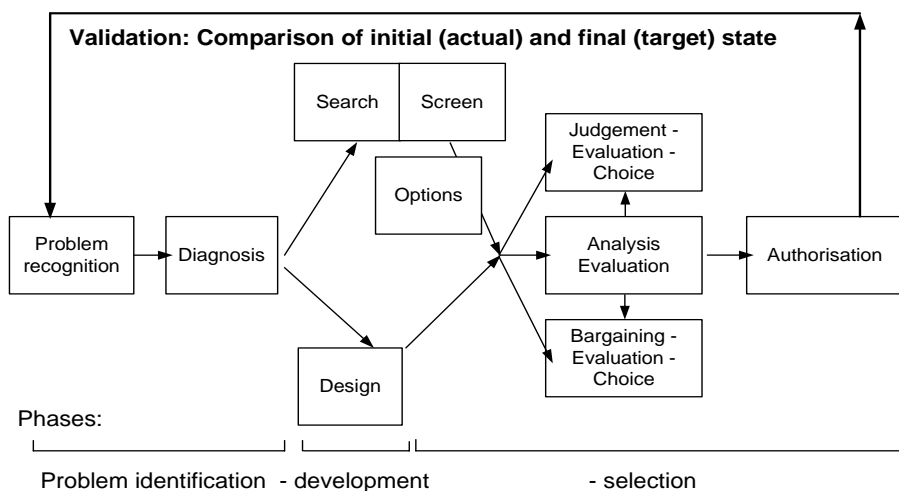


Figure 3: General model of the (phased) strategic decision process.

The starting point of an adequate problem solving **strategy** is a thorough and thoughtful analysis of the situation concomitant with suitable system modelling. The phase of **problem identification** is accompanied by the formulation of **goals** for good decisions are goal-oriented decisions. **Good decisions** usually are also characterised by a careful processing of several alternatives. In order to assemble material for an option analysis, one has to, on one side, search for information and, on the other hand, design the proposed project or facility. The option analysis is part of the screening activity.

An attempt to transfer (and illustrate) the concept is presented in Figure 4:

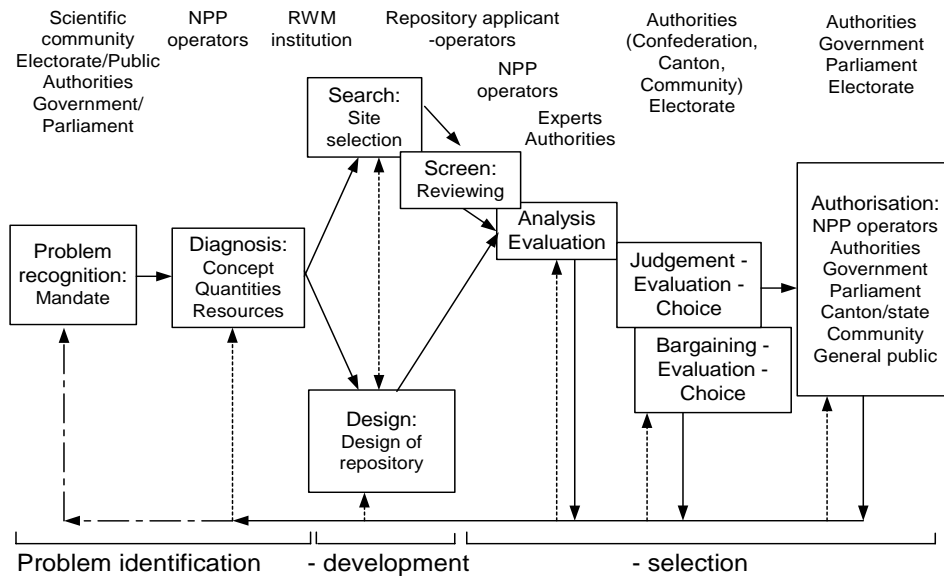


Figure 4: **Phases** of the decision-making process in Swiss radioactive waste management. The process of each project (interim storage, repository facilities) consists of several **stages**: from general licence to closure licence and sealing. The planned **feedbacks** (incl. criticism) are marked with dotted lines (.....). Unplanned feedbacks, such as the rejection in a referendum or financial cutbacks of waste organisations, or even new claims for concept change, are shown as broken lines (- - - -, bottom left). At the top, the main **stakeholders** are indicated.

As mentioned, problems are defined by the perception of the difference between a final state (sought after) and an actual state (unwanted). Decision problems are **well-structured** if the decider is familiar with their initial state and the goal state as well as a defined set of transitions. **Complex** problems are intransparent, having multiple goals, situational complexity, and time-delayed effects.

The following procedure may help to improve the quality of decision making and, supposedly, to finally reach a “good” decision (for terms and sequence see Figure 1 and Figure 3):

Element 1: Problem finding

- Define the problem (problem identification).
- Relate the problem to goals, values, and needs.
- Frame the issue and acknowledge biases.
- Investigate at the appropriate level (level of analysis, scale).

Element 2: Institutional arrangements

- Identify the primary and secondary stakeholders.
- Measure their goals, objectives, views, constraints, and agendas.
- Assess similarities to and differences from your concerns.
- How do they interact with each other?
- How are the social levels interrelated? (individuals, groups, institutions, society)

Element 3: Information gathering

- What information do you need regarding facts, assumptions, stakeholders’ values to develop a systematic approach?
- Identify the biases – how do you address them?
- What are the cost and benefits of collecting additional information?
- Relate specific solution procedures to the types of information.

Element 4: Choice process

- Consider the choice approaches in addressing the problem.
- Will the choice process involve others?
- Appraise techniques.
- Make a trade-off between effort (cost) and accuracy (benefits).
- Formulate the decision criteria.
- Evaluate the implications of so-called “nestedness” (interrelations), complexity and legitimisation on the selected solving procedure.

Element 5: Implementation

- Consider feedback, control and accountability in implementing.
- Formulate legitimacy criteria (results as plausible solutions for the relevant problem).
- Periodically review the decision-making process (DMP).

There are no “simple” decision rules, patterns, or strategies how to proceed in complex situations such as radioactive waste governance (RWG), especially as today’s deciders cannot assess the quality of the outcome of their actions taken (and as they cannot be called to account). And yet, some requisites or positive features of a task may be formulated:

- With a rising number of options one decides rather more attribute- than option-oriented – no information is looked for *one* option on *all* attributes (of this particular option), but information on *all* options on the most relevant attribute, then on the second-most relevant one, *etc.*
- An increase of attributes enhances the confidence of the deciders in their judgements and choice.
- Time pressure raises the error rate.
- Concrete information is preferred by the deciders to implicit information.
- Clear information facilitates deciding and is utilised more readily.
- The completeness of options influences the decision behaviour; if an option comes off well on one attribute, it is inferred that it comes off correspondingly on an attribute with less information.
- The format of presentation comes in, *i. e.*, the manner how options are presented (“framing”).

The following are **attributes of a “good” decision-making process:**

- *Stepwise:* planning phases with milestones
- *Periodic orientation, reviewing and interim decisions:* for technical and political back-up
- *Open and comprehensive option analysis*
- *Iterative, with opportunities for recourse* (and mutual learning ...)
- *Reliable, accountable:* unambiguous rules to be complied with (only modifiable by prior consent)
- *Consistent, minimising conflicts:* technical and non-technical sets of criteria
- *Coherent, continuous:* for sufficient trust in “the system”
- *Traceable:* arguments and reasoning have to be fully comprehended by interested parties
- *Early involvement of local and national stakeholders*
- *Transparent:* in broad discussion fora aspects may be put up for discussion at early stages
- *“Fair” procedure and treatment of the intra- and intergenerational equity issues* (taking into account the twofold – spatial and temporal – asymmetry): The benefit of nuclear electricity is distributed whereas the cost/risk of waste disposal is locally concentrated and transferred to future generations.

To reach sustained decisions among individuals, groups and organisations – as in radioactive waste governance – there is a need for “**informed consent**” which, in turn, requires an explicit elaboration of many possible ways and consequences of courses of actions.

Environmental problems usually are complex and ill-structured or ill-defined. In such situations decision research does not offer a dominant paradigm but resorts to concepts and methods put forth by many scientific fields, like sociology, administrative sciences, political sciences, or psychology. Strategies of participants, be they individuals or groups, may greatly differ. The **optimum solution** cannot be unambiguously determined. Only the relatively best of the solutions found can be detected.

In addition to the difficulty of problem definition it has to be acknowledged with radioactive waste that it poses – in terms of the theory of decisions – a so-called “**implicit problem**”, *i. e.*, it was caused by a preceding activity or decision (to utilise radioactive substances) and now constitutes a (factual) constraint. In so far it is “rational” to link the issue of radioactive waste with the operation of nuclear power reactors. The uneasy situation, however, also has to be accepted that research in this area – in whatever direction it goes – is “supportive” research, this term coined by the Swedish implementer SKB in their R&D endeavour to implement final disposal, mildly criticised as “supporting research” by the independent advisory body KASAM 1995 (p. 59-60).

Structure for comparisons

If we try to apply the findings to the scope and focus of COWAM 2 we may come up with the following structure for a synopsis of DMPs in various countries, consisting of five parts³:

A. Look at what was done in the **PAST** and enquire about:

When was the issue of radioactive waste politically raised?
Is there a dedicated programme/plan to find a repository site?
Do site selection criteria exist? Which?
Has there been public involvement? How? How deep?
Was the programme a failure or a success?

B. Find out the **CONTEXT** the decision-making process is in:

B-I Framing: Embedding in the national policy

What is the energy policy? Nuclear? Phase-out?
Is there an accepted national RWG strategy?
Is the DMP explicitly addressed in the RWG policy?
Is there a systematic reconsideration of strategic RWG options during the DMP?
What is the influence of the DMP on the national RW policy?

B-II Current official research strategy

Research on reversibility of option?
Research on retrievability of waste?
Laboratories or sites involved/planned?
Are there political decisions to be prepared with expected scientific results?

B-III Legislation

Is the DMP explicitly addressed in the RWG legislation?
Is a systematic reconsideration of strategic waste management options addressed?

³ Modified according to the discussions in the 4th meeting (July 5, 2005) and corresponding to the (final) Appendix called “Synopsis of national decision-making processes”.

What are the main decisions to be taken/problems to be solved? By whom? When?

C. And the ACTORS are:

Roles and responsibilities

Are they clearly separated in the national RWG?

C-I Formulary stakeholders

Waste implementing organisations

Main waste producers

Regulatory bodies

Research institutions

(Other) expert institutions

Committees: Terms of reference? Advisory (to whom)? Authorised? Permanent?

C-II societal stakeholders

What is the overall attitude towards nuclear energy?

Political parties against nuclear?

Associations/NGOs opposed to nuclear? Degree of opposition?

Associations at the local/regional level: Scope? Role institutionally recognised?

Industrial associations?

Others?

D. The DECISION-MAKING PROCESS itself is composed of:

D-I Substantive principles and goals

Types

Authors: Who defined the principles and goals? Was there a public debate?

Have the principles and goals been adhered to since the *beginning* of the process?

Scope of debate: Just technical issues or also "compensation"/regional development?

Learning: Is there a systematic reconsideration of substantive matters?

D-I Procedural principles and goals

Types

Authors: Who defined the principles and goals? Was there a public debate?

When were they defined? (before/during the DMP?)

Have the principles and goals been adhered to since the *beginning* of the process?

Is there a clear structure with milestones and interim decisions?

What is the subject of the DMP: energy policy options or concrete (siting, etc.) projects?

Does the DMP cover all phases of the *national* RWG strategy?

Are all relevant stages of *siting* considered?

Is the DMP based on the procedure described in a specific regulation?

Who is the initiator of the process?

Are there clear responsibilities and roles of diverse actors in the DMP?

Is there a systematic reconsideration of procedures? (recourse, feedback)

Is there a process monitoring? Which institution is in charge? What is its legitimacy?

Is there a periodic evaluation? Is it inclusive? What are its status, relevance, and impact?

Are there regulations allowing for the "synchronisation" of the DMP?

E. And the INVOLVEMENT OF SOCIETY is such:

Is there a systematic public participation in the process? What is its level?

Which "publics", stakeholder groups, perspectives are involved?

Are demands of future generations considered? How?

Are demands of today's generations considered? How? Is compensation foreseen? How?

What is the goal of public participation? Whose goal?
 Is there a specific legislation to explicitly include the public in the process?
 Is there an up-front/early involvement of local actors? Is it continuous?
 What instruments and/or institutional assistance are applied for involvement?
 Are there provisions to improve the competence of (local) actors?

This may be visualised as follows:

