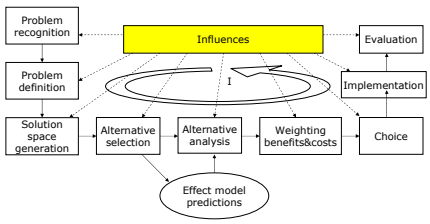
Knowledge at risk

Mental model mapping – a method to link knowledge and practice

M.J.Kolkman[1]*, A. Van der Veen[1], M. Kok[2],

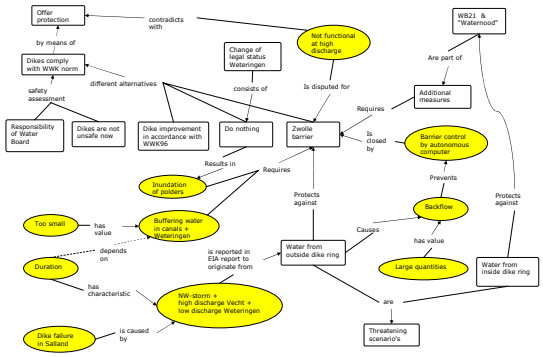
1) University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands
Faculty of Engineering Technology, Water Engineering and Management group; m.j.kolkman@utwente.nl
2) HKV Consultants, Lelystad, the Netherlands

1. Decision makers sometimes appear to disregard technical argumentation in favour of administrative or political arguments, which is hard to comprehend from a technical perspective. The question rises what drives the selection of information used to influence the decision making cycle.



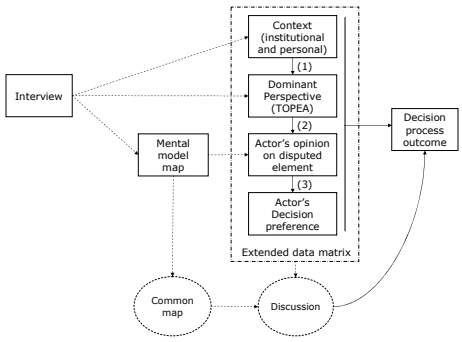
3. Mental model and perspective type can be elicited from stakeholders by document analysis and interviews.

The structure of the knowledge can be visualised in a mental model map. The map contains the key concepts and their relationships, in use by a specific stakeholder when building his/her decison argumentation. Map elements on which stakeholders differ in opinion (indicated with ovals on the map) are collected in a data matrix.

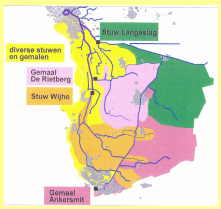


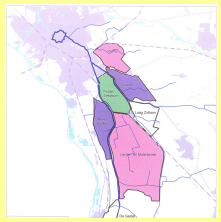
5. The following figure summarises the method. The data matrix can be used to discuss the decision process arguments and outcome, in an attempt to overcome frame conflicts.

Such an attempt may include the construction of a common mental model map that can be used to explain the decision finally taken.

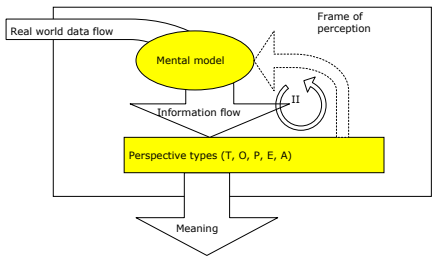


6. The method has been applied to analyse the arguments used in a specific issue in regional water management: the environmental impact assessment [1)] of the "DAR 1+2" dike improvement plans of the Groot Salland Water Board. The EIA report presents a storm surge barrier in Zwolle as the preferred solution. The pictures represent some of the disputed elements present in the case.





2. The answer lies in the process of construction of meaning [2)]. The real world data flow is filtered by a stakeholder's mental model. This mental model contains the knowledge a stakeholder considers to be relevant for the decision problem. The resulting information is subsequently valued from the specific perspective the stakeholder takes with respect to the decision problem. The resulting meaning relates to the specific interests of the actor. Mental model and perspective are in close interaction.



4. The data matrix columns contain the individual stakeholder's opinion on the specific element that are subject to dispute.

Five perspective types (noted across the columns) are used to explain a stakeholders opinion on, or interpretation of knowledge elements.

The data matrix can be used to untangle decision controversies. It reveals assumptions and interpretations of individual stakeholders. It also reveals frame conflicts between stakeholders.

	Disputed element	Observations from interviews	Scores	1	2	3	4	5	6	7	8	9	10	11	12	13	14
-	-	Initial (primary) frame perspective type	T,O,P,E,A	O	T	T	E	O	T	T	P	O	T	T	O	O	E
		Responding (secondary) frame perspective type	T,O,P,E,A	E	E	-	O	P	O	E	P	P	E	O	P	P	T
2	WWK Dike ring principle	Must be physically closed ...vs... can have an open discharge canal on condition that the safety norm remains guaranteed.	Closed (G), Open (O)	G	O	G	G	G	G	O	G			G, O	G	G	(G)
16	Province WWK approval	Province must dissociate and limit to assessing the reasonability of the EIA report contents ...vs... can fully participate on contents aspects also from the start of the project	Distance (R), Involvement (M)	R	M	R	(M)	M	R		R *	R		M		R	
17	Province broad task	Province has a broader task compared to the Water Board ...vs... Water Board takes care of all tasks and the Province authority limits to approval only	Broad (E), Limited (G)	E		G	-	-	E		E	(G)			E	G	
33	Water system discharge peaks	Discharge peaks from the river Vecht and the Sallandse Weteringen do not coincide ...vs... in the past the discharge peaks were always observed to coincide	Differ (N), Coincide (S)		S		-	S	N	S		N	S	-*			S
42	Water system Zwolle city damage	NW-storm surge can cause serious damage in the city of Zwolle ...vs... in the past storm resulted in water hindrance only	Serious (S), Negligible (V)		V		-	-	-	V			V	V	(S)	(S) *	V
46	Barrier efficacy	The barrier increases the safety of the Zwolle city: a) Yes, b) Also at high Weteringen discharge, c) At low Weteringen discharge only, d) Never	a, b, c, d		d	c	(a)	-	a	d			d	d		a	(d)
-	Barrier decision preferences	Pro, Contra, Acceptable Compromise, Neutral (no opinion), Superfluous (but opinion irrelevant	P, C, A, N, S	P	C	P	A	N	P	C	~ P	P	C	C, S	P	P	C, P

T: Technical. A functional and rational orientation with regard to system behaviour.
O: Organizational. An interpretive orientation with regard to institutional and legal responsibilities and their consequences.
P: Personal. A political and individual orientation with regard to position and power.
E: Ethical. A moral orientation with regard to codes of conduct and values (e.g. environment).
A: Aesthetic. An orientation on the beauty and harmony of a design.

7. The case study revealed two conflicting frames. The central Technical issue in our case appeared to be water detention in Salland, from either extreme precipitation or storm surge, and not the Zwolle storm surge barrier. The central Administrative issue appeared to be the "closed dike ring" principle. Throughout the dike improvement procedure proponents of the frames have tried to convince the first (Water Board), the second (Province Executive Council) and third (Ministry of Transport, Public Works and Water Management) authorities responsible of their arguments. The controversies were not resolved.

We suggest that the root of the frame conflict lies in the unacceptability of the deployment of inundation areas for extreme high water events outside dike ring 53, where at the same time these inundation areas are effectively already operational for storage of excess local drainage water.

The controversies in the case can be explained by institutional and political interests, much more than by lack of communication between knowledge producers and knowledge users. It appears that a problem of administrative nature on the national level was solved by a technical measure on a regional level.

Technical knowledge was put aside using arguments like "experts are divided", "complex situation which cannot be adequately modelled" and "large uncertainties present unacceptable risk".

The case shows how knowledge is at risk of being disregarded in favour of political or administrative arguments.

1) EIA-report (2001). Dijkverbetering Acther Ramspol, Projectnota/MER, Sallandse Weteringen - Zwolle, deelgebied 1-2. Grontmij Projectbureau DAR. Zwolle, Waterschap Groot Salland.

2) This poster is based on the PhD thesis: Kolkman, M. J. (2005). "Controversies in Water management: frames and mental models", University of Twente, Enschede, 17 juni 2005. **In press**.