Implementing optimal and resilient freshwater supply

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Introduction

- The Netherlands – a water rich country coping with drought?
- Climate change: drought periods more frequently
- Risk of salinization increases

- Objective: How to develop resilient investment portfolio to prevent water shortages

Dutch Deltaprogramme (2nd)

Dutch Deltaprogramme for climate change

A. Flood protection

B. Freshwater supply

Long list of measures to combat water shortage

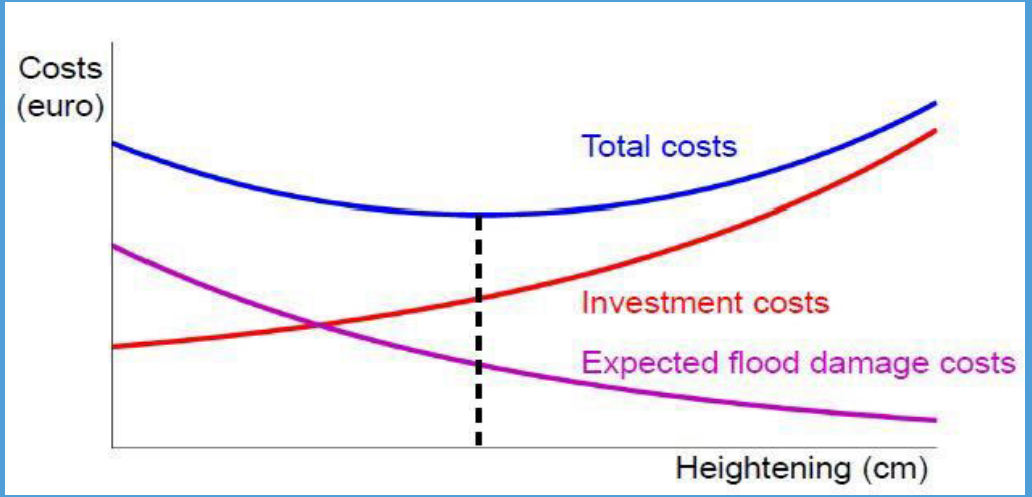
Dutch Deltaprogramme Freshwater

- Cost effectiveness analysis of measures in main water system (expand reservoir Lake IJssel), not in regional waters (hydrological models)
- Benefits of measures proved to be difficult to compute, private adaptation not taken into account

Lessons learnt from Dutch water policies (1)

Policy 1. Flood protection

- CBA to compute optimal measure
- Spatial solutions might be cheaper in low population density areas



Lessons learnt from Dutch water policies

Policy 2. Water pollution reduction

- Public waste water treatment plants
- Firms taxed for pollution discharge
- Prevent public measures to become obsolete, due to firms' rapid adaptation to water pollution taxes

Criteria for ranking potential measures 1.

- Innovation potential. If more technological development is expected, than more potential for innovation.
- Adaptation. Private measures are preferred over public measures, more knowledge about local situation.
- Private versus public good characteristics. Demand reducing measures are preferred over supply augmenting measures.

Criteria for ranking potential measures 2.

- Risk reduction. Entrepreneurs are risk averse. Over investment in private measures.
- Minimising market effects. Large scale measures are more likely to distort the market.
- Sequence of measures. Public measures may substitute (more efficient) private measures.

Summarizing criteria for ranking potential measures

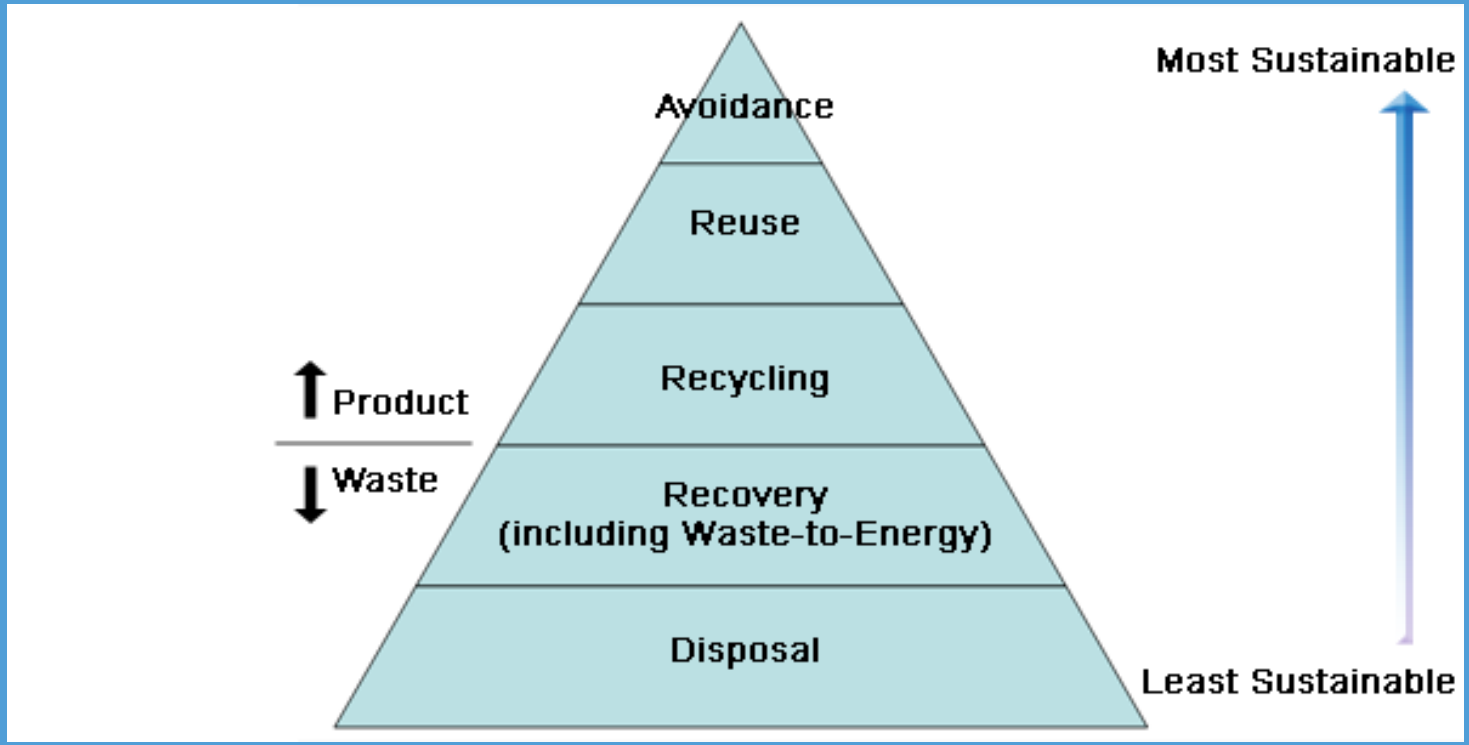
A. Demand reducing measures are preferred over supply augmenting measures (external effects, private and public good characteristics of water)

B. Private measures are preferred over public ones (adaptation, risk minimization, sequence of measures)

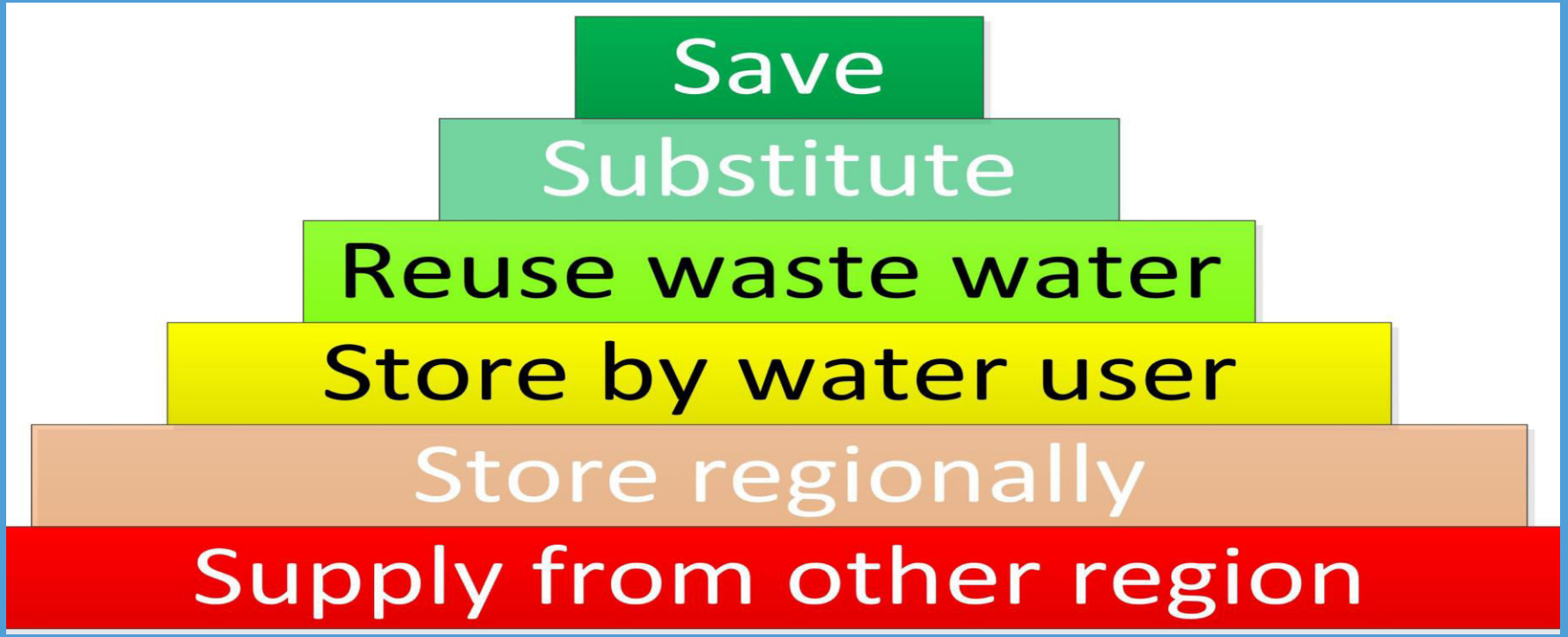
C. Measures with potential for innovation are preferred

D. Small scale measures are preferred over large scale

Waste hierarchy (EU waste directive)



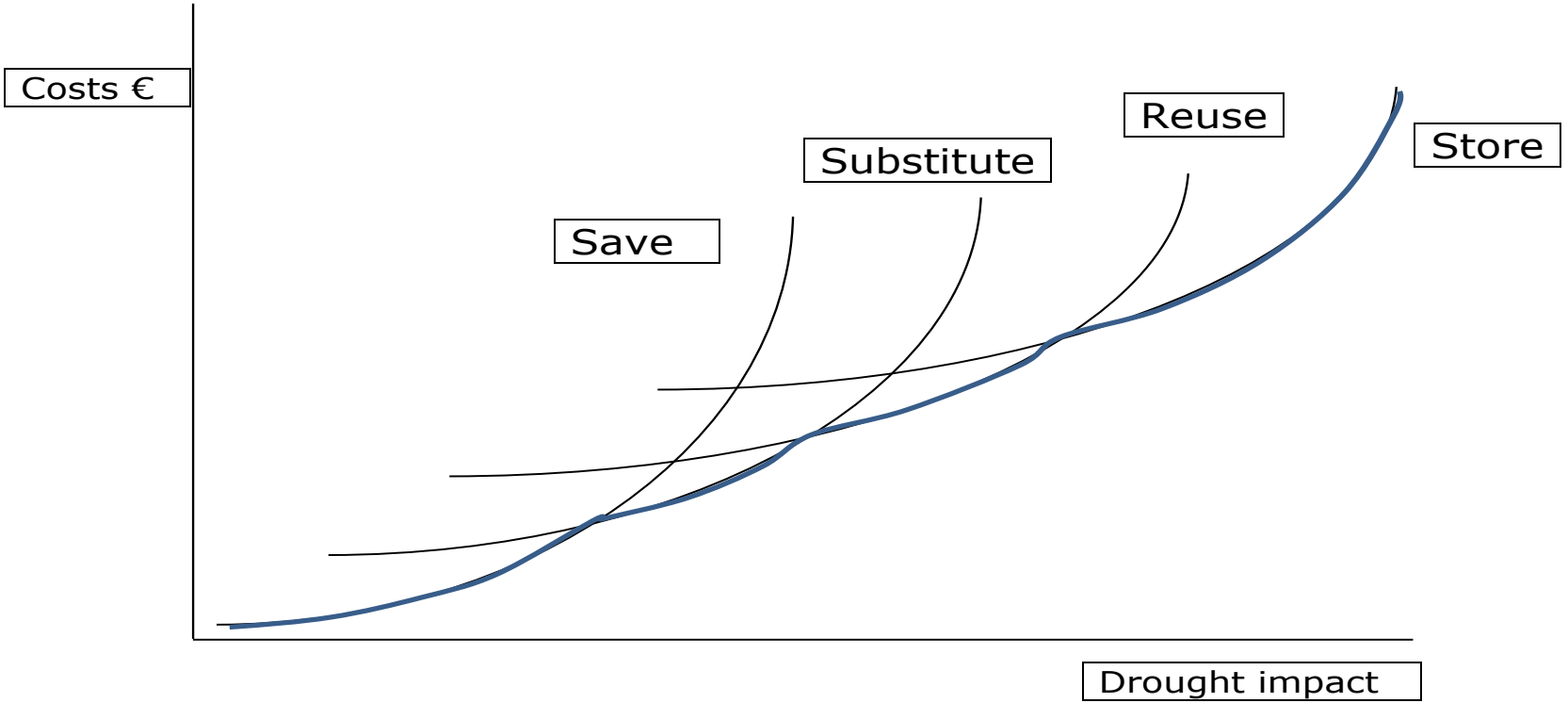
Water supply hierarchy



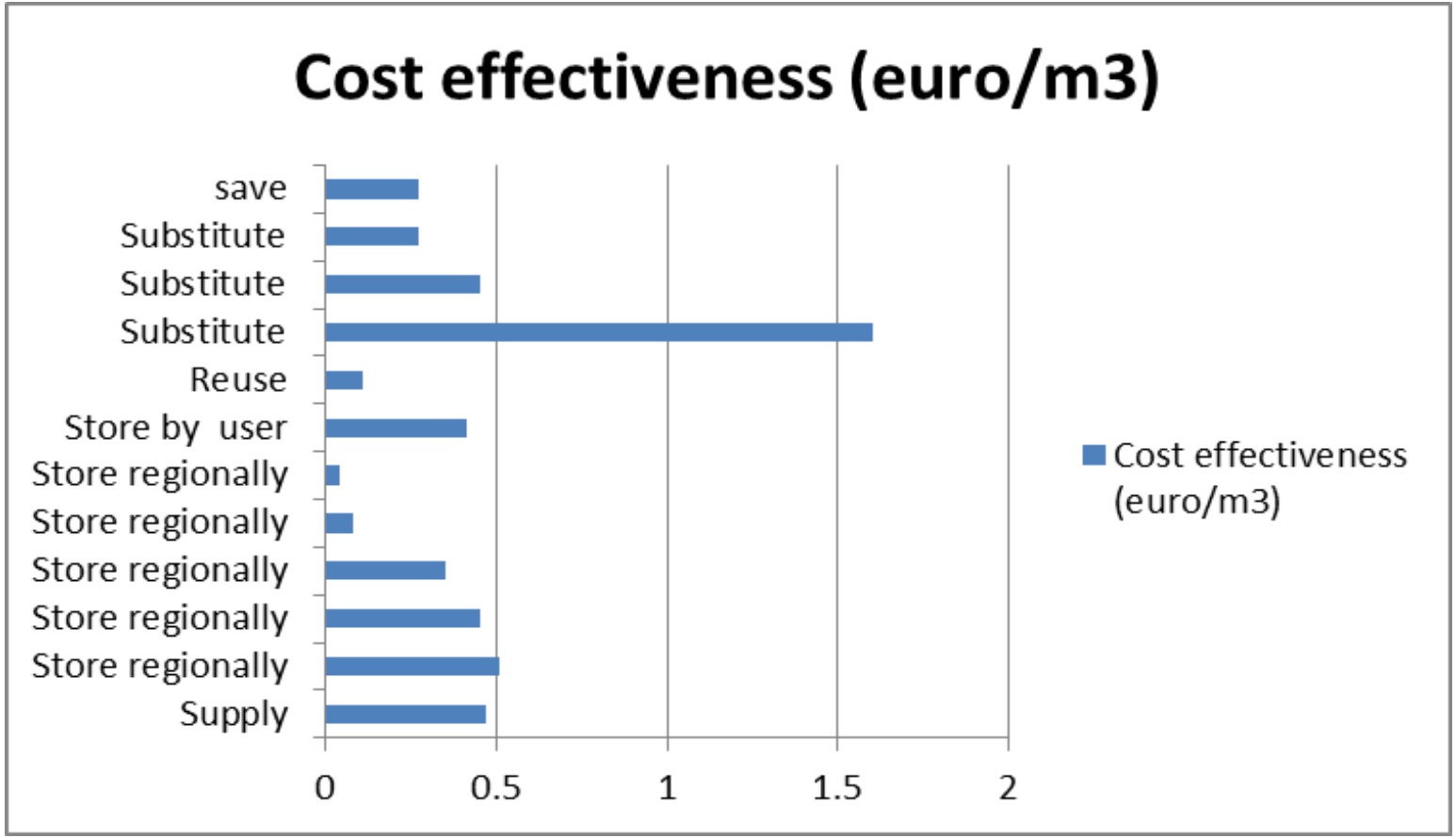
Ranking measures for water supply hierarchy

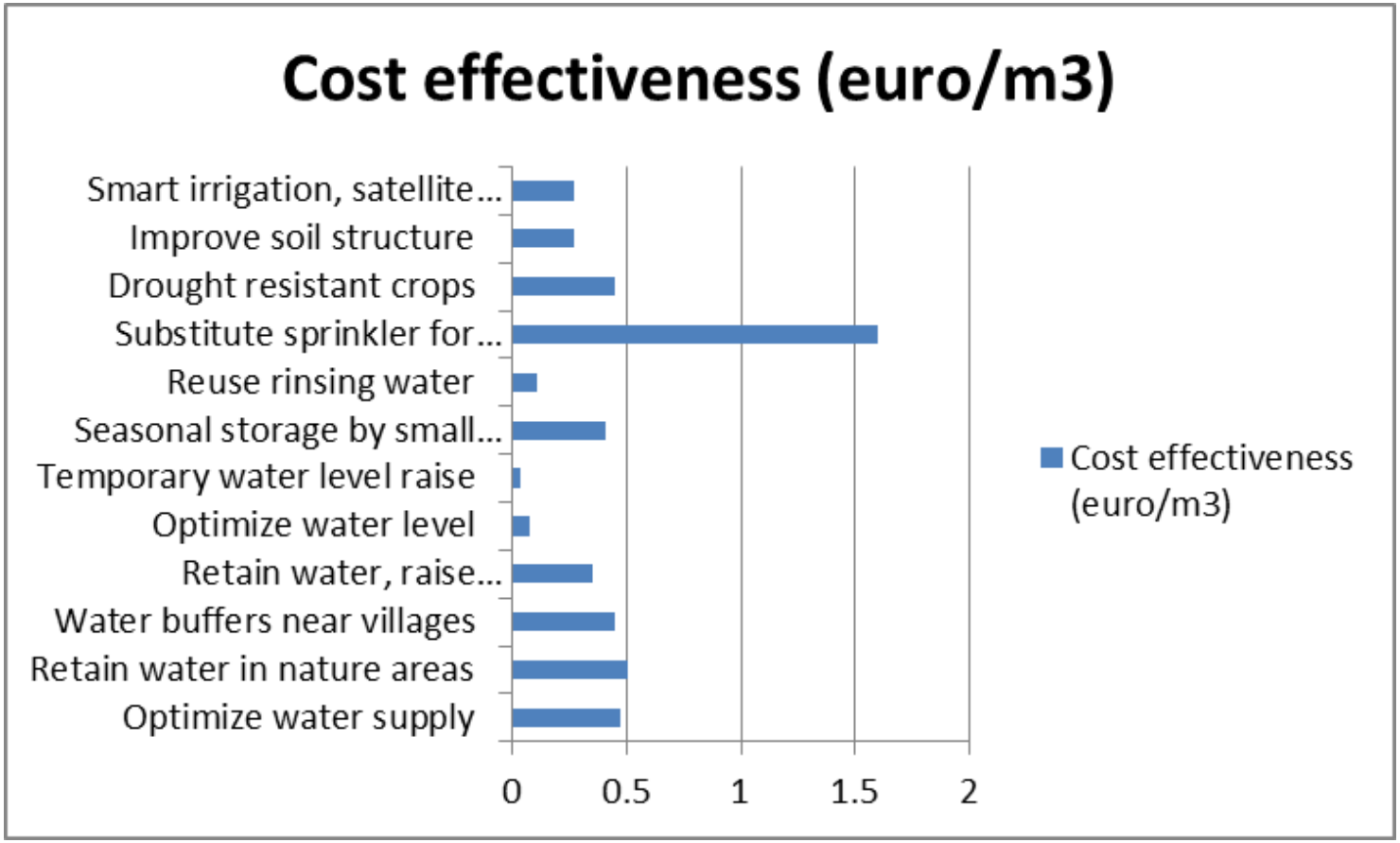
	Supply hierarchy	Dem/ Supply	Priv/ Publ	Inno-vation	Sca-le	Costs	Example
1	Save	Dem	Priv	++	S	+++	Less irrigation
2	Substitute	Dem	Priv	+++	S	+	Drip irrigation
3	Reuse wastewater	Dem/ Supply	Priv	+++	L	--	Greenhouse
4	Store locally	Supply	Priv	+	S	-	Water basin
5	Store regionally	Supply	Publ	--	L	--	Reservoir
6	Supply other region	Supply	Publ	---	L	-	Canal

Switching steps in hierarchy



Measure	Category	Effect (Mm3)	Cost effect (euro/m3)	Rank CE	Rank hierarchy
Smart irrigation, satellite info	save	2.5	0.27	4	1
Improve soil structure	Substitute	1.7	0.27	4	2
Drought resistant crops	Substitute	3.3	0.45	9	2
Sprinkler for drip-irrigation	Substitute	0.1	1.6	13	2
Reuse rinsing water	Reuse	0.2	0.11	3	3
Seasonal storage by weirs	Store by user	4.8	0.41	8	4
Temporary water level raise	Store regionally	0.8	0.04	1	5
Optimize water level	Store regionally	1.4	0.08	2	5
Retain water, raise drainage base	Store regionally	2.1	0.35	6	5
Water buffers near villages	Store regionally	0.4	0.45	9	5
Retain water in nature areas	Store regionally	1.4	0.51	11	5
Optimize water supply	Supply	1.7	0.47	10	6


Cost effectiveness (euro/m3)
save
Substitute
Substitute
Substitute
Reuse
Store by user
Store regionally
Store regionally
Store regionally
Store regionally
Store regionally
Supply
0
0.5
1
1.5
2
Cost effectiveness (euro/m3)


Cost effectiveness (euro/m3)
Smart irrigation, satellite...
Improve soil structure
Drought resistant crops
Substitute sprinkler for...
Reuse rinsing water
Seasonal storage by small...
Temporary water level raise
Optimize water level
Retain water, raise...
Water buffers near villages
Retain water in nature areas
Optimize water supply
0
0.5
1
1.5
2
Cost effectiveness (euro/m3)

Advantages for process water supply

- Rule of thumb to include important elements in the decision on measures, overlooked in standard CBA
- Facilitates simple communication on efficient water supply measures
- Without extensive hydrologic and economic models, measures can be easily ranked
- Ranking can be changed, based on CBA that takes the criteria specified into account

Next steps

- Quantify contribution of innovation, adaptation and external effects, in effectiveness of measures
- Elaborate instruments to implement methodology, using waste hierarchy’s experience
- Start pilot

Questions?

Thank you!

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